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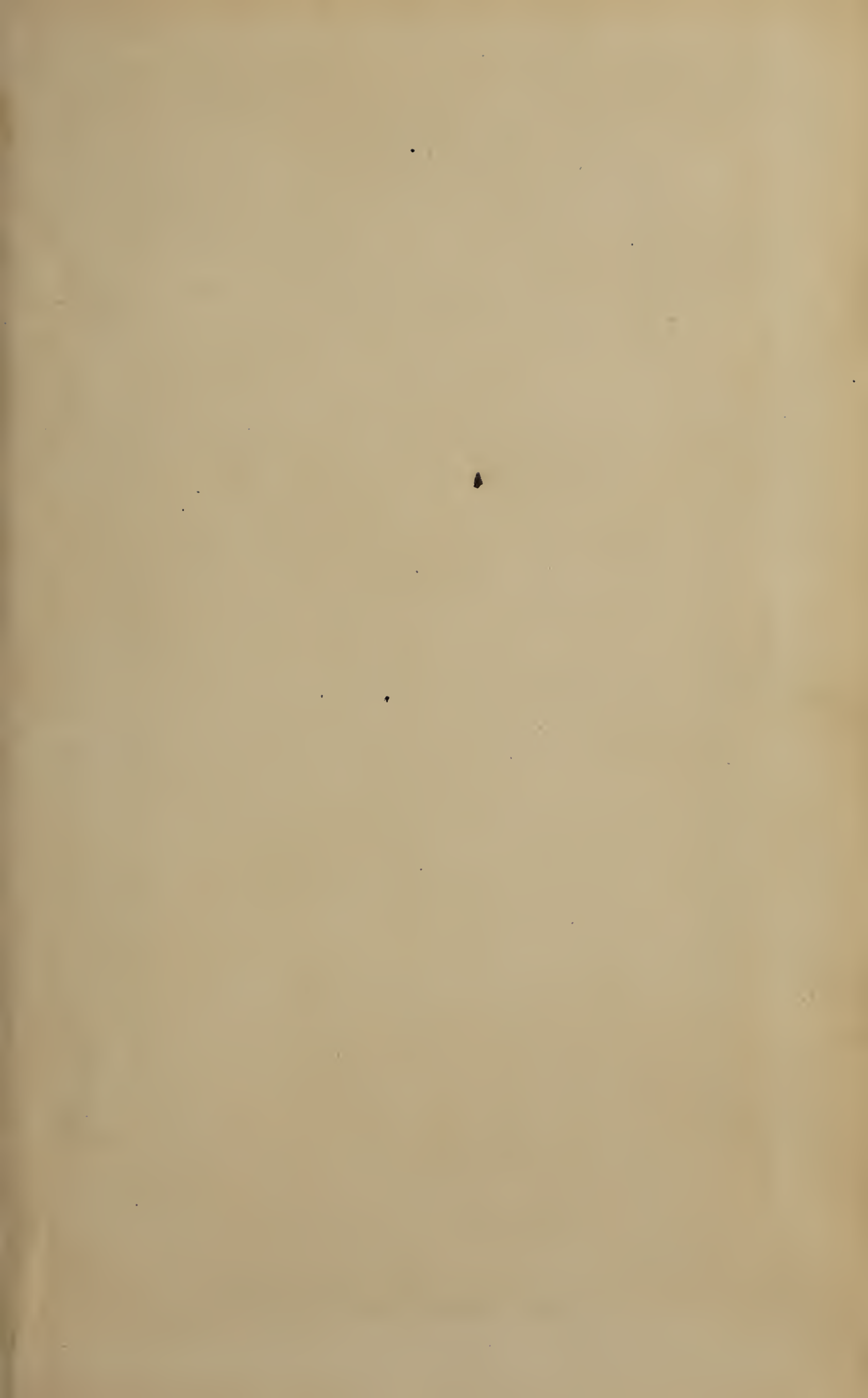
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THE JOURNAL OF THE
"MIDLAND UNION OF NATURAL HISTORY SOCIETIES,"
WITH WHICH IS INCORPORATED THE ENTIRE
TRANSACTIONS OF THE BIRMINGHAM NATURAL
HISTORY AND MICROSCOPICAL SOCIETY.

EDITED BY
E. W. BADGER & W. HILLHOUSE, M.A., F.L.S.

"Come forth into the light of things,
Let Nature be your teacher."
Wordsworth.

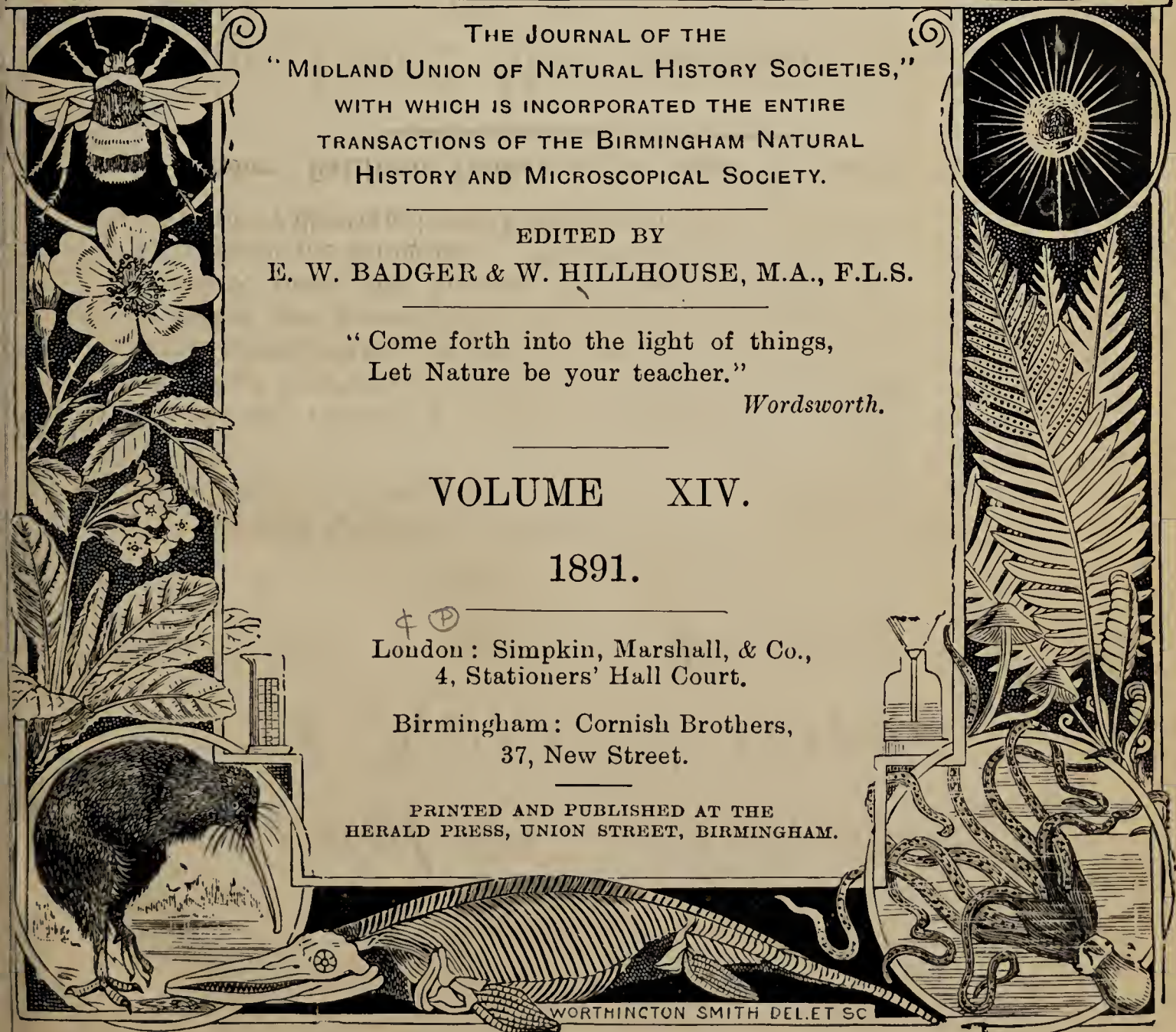
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P R E F A C E .

ALTHOUGH there is no particular merit in mere prolongation of existence, the continuance of a local scientific magazine for a period of thirteen years may be remarked upon as a most unusual circumstance. This is not in the present case due to the amount of support the enterprise has received; but is simply owing to the determination of the conductors not to discontinue their labours as long as there is the least chance of their work being appreciated and recognised. It is apparently too early to expect any recognition from the general public for a scientific serial which has nothing to commend it to ordinary public favour except an honest endeavour to provide a medium for the publication of such local papers as are likely to be interesting to local scientists. The communications made to the "Midland Naturalist" are quoted in the scientific literature of the time both in Europe and America, and the Editors cannot but remember that they have published many valuable contributions to science which otherwise would not have been placed on record.

As the appreciation of natural science becomes more general, such work as the "Midland Naturalist" has done, and hopes to continue doing, will be more and more regarded, and it is the realisation of this fact which accounts for its prolonged existence. Every student of natural science in the Midland Counties ought to be interested in the continued issue of this periodical, which is unique as an organ for the publication of the work of local scientists.

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THE MIDLAND NATURALIST.

"Come forth into the light of things,
Let Nature be your teacher."

Wordsworth.

THE FLORA OF WARWICKSHIRE.*

County floras have to be used and judged from two points of view, the one local and the other general. They are wanted on the spot as a guide to collectors, and to give utility and precision to the work of local societies. They are wanted by the general geographical botanist to give him a summary for ready reference of the facts bearing on his science which a given area yields. To fulfil both these requirements in a satisfactory manner the author of a local flora ought to be well acquainted with every part of the area which his book deals with ; he ought to know fully, and be judicious in using, the material which his predecessors and fellow-workers have gathered ; he ought to be well acquainted not only with plants of easy, but also those of difficult determination ; and he ought to have such a general knowledge of geographical botany as to understand what is important and what is trivial. All these conditions are fulfilled by the author of the present work in a highly satisfactory manner. He has had more than twenty years' experience of field work in the county, and, in spite of scanty leisure, has explored personally every part of it. He is well-known as one of our best critical British botanists, and he possesses the requisite power of judgment and organisation necessary to arrange in an orderly and readily accessible way the crowd of details he has collected. The result is that he has produced a book which is one of the best county floras that has been written, and which will stand as a permanent memorial of his diligence and ability.

The interest of Warwick as a county lies in its being thoroughly typical of Midland England, apart from any disturbing influence on its flora brought about by proximity to mountains or the sea. The area of the county is under a

* "The Flora of Warwickshire : the Flowering Plants and Ferns," by J. E. Bagnall, A.L.S. ; the Fungi by W. B. Grove, M.A., and J. E. Bagnall. 8vo, pp. xxxi. and 519, with map. London : Gurney and Jackson ; Birmingham : Cornish Brothers.

thousand square miles. Although it is in the very centre of England, and is the watershed between Thames, Trent, and Severn, its highest point only attains a height of 855 feet above sea level, so that it all belongs to the warmest (inferagrarian) of the six zones of climate into which the surface of Britain is divided by geographical botanists. Mr. Bagnall gives a map of the county, and, to insure its thorough exploration, has divided it into ten districts founded on the river drainage, and worked each of these as a distinct unit. The short introduction contains a sketch of each of these districts; a brief but sufficient sketch of its Geology by a promising young resident geologist, Mr. Bernard Badger, B.A.; and a note upon its Temperature and Rainfall, which latter, of course, present no striking feature of individuality.

The great bulk of the book is occupied by an enumeration of the plants, the distribution of which is traced through the ten drainage districts, and abundant detail given about the special localities of the rarities. Rubi are very abundant in Warwickshire, and Mr. Bagnall, who is a pupil of Bloxam, has worked out the local forms very carefully, and sent sets of specimens to the herbaria of Kew and the British Museum. The Flowering Plants and Ferns occupy 328 pages. The eighth edition of the London Catalogue is followed as a standard of nomenclature and species limitation. The Flowering Plants and Vascular Cryptogamia have been worked so thoroughly that it is not likely that many additions will be made to this record in the future. The Mosses occupy forty-eight pages, and 236 species are recorded. Here, again, it is not likely that many novelties remain undiscovered. The Hepaticæ have been worked less thoroughly; forty-four species are recorded, and probably the number might be raised to 100. Very little has been done in Lichens; about 100 species are registered, and probably the number might be raised to 500, so that there is abundant work still to be done in this department. In Mr. W. B. Grove the county possesses a very competent resident mycologist. He has co-operated with Mr. Bagnall in the eighty pages of the book devoted to Fungi, and they very judiciously confine their list of stations to the Hymenomycetes and Gastromycetes. Then follows a tabular summary of the plants of the county, as traced through the ten drainage districts, and compared with the neighbouring shires of Leicester, Northampton, and Oxford. The book concludes with a very interesting sketch of the progress of botanical work in the county from the time of Ray down to

the present day. The best known botanists of past generations who have collected within its bounds are Purton, Withering, Perry, Bree, Bloxam, and Baxter. At Rugby School there has been a natural history society since 1867. A Warwickshire man, whose name is briefly mentioned in this sketch, Mr. Thomas Kirk, formerly of Coventry, has been for many years the leader of botany in New Zealand, and has accumulated full material for a new flora of that island, which we hope to see published, under Government auspices, before long.

The plants of Britain, with very trifling exceptions, all inhabit the European Continent, but they are distributed over the Continent and our own island in a great variety of different ways. Out of the 532 plants which are spread throughout the whole length and breadth of Britain, Mr. Bagnall records for the county 501; out of 409 species which have their head quarters in the south of the island there are found in Warwickshire 285; out of 127 characteristically eastern species there are found in Warwickshire 31, and out of 90 characteristically western species only 8; out of 201 species which are characteristic of Scotland and the mountains of the North of England and Wales only 19 reach Warwickshire.

It is a great convenience to have a full county flora like this printed in legible type, and yet not too thick a volume to be carried about in a great-coat pocket. This has been managed by careful contrivance in the present case, by employing a special kind of paper—firm, but yet so thin that 564 pages occupy a thickness of only about an inch. It will make the mouths water of many of the writers of local floras, past and prospective, to hear that there is a region in England where they form a committee of twelve gentlemen to guarantee the author against pecuniary loss, and where they subscribe for 430 copies out of 500 before the book is printed. This is a state of things very creditable to the kindness and business capability of those who have planned and carried it out.

In the way of corrections or criticisms upon points of detail I have very little to say. The numerical summary is not clear; on page 466 Mr. Bagnall gives the number of Warwickshire plants (flowering plants and ferns) at 852; but on page 467 his natives, colonists, and denizens add up to 905, and the author does not explain how the discrepancy arises. The *Barbarea* of cultivated fields on page 18 is probably *B. intermedia*; *B. stricta* is always a plant of riversides and ditches. *Rubus dumetorum* var. *concinus*, as described in Lord de Tabley's paper in the "Journal of

Botany" for 1870, is identical with *R. tenuiarmatus* of Lees, but quite different from *R. corylifolius* var. *purpureus* of Babington. It is the common bramble about Matlock, and often did duty for *R. nemorosus* in Bloxam's Fasciculi. The name of the great German authority on grasses is Hackel, not Hæckel. On page 27 the generic and specific name of the wild *Raphanus* are both misspelt. The name of the same authority should always be contracted in the same way, but for Robert Brown Mr. Bagnall has three versions, "R. Br." "Brown," and "Br." Under *Helianthemum*, Persoon could not possibly be the founder of a genus in which Miller founded a species, seeing that the former wrote sixty years after the latter. But these and such-like are minor matters of detail, and do not affect the sterling merits of the work.

J. G. BAKER.

Kew, Dec. 18, 1890.

THE BIRDS OF OXFORDSHIRE.*

Mr. Aplin has given us an excellent and reliable work on the birds of Oxfordshire, each page of which bears evidence of much careful research and preparation. It is, perhaps, a matter of regret that the author's remarks on the avifauna of a very interesting district have to be restricted to an area of such very irregular outline, and limited to a space of land, near the centre of England, represented by a length of about fifty-two, and a breadth varying from seven to twenty-seven miles.

In a work of this class, dealing exclusively with creatures of such rapid movement as birds, we are by no means certain that it is desirable, in each separate case, to confine the notice within what are really purely artificial boundaries, designed for local and political purposes, and that it might not have been as well to have dealt with a somewhat more extended and natural faunal area—like the Upper Thames Valley and surrounding districts, or the Upper Thames and its tributaries, and thus include some portion or other of the neighbouring counties of Warwick, Northampton, Bucks, Berks, Gloucester, and Worcester, which, to a greater or less extent, touch upon the confines of Oxfordshire. Indeed, the author, although adhering with praiseworthy fidelity to the defined limit of his work, appears to be conscious of the dis-

* "The Birds of Oxfordshire." By O. V. Aplin, M.B.O.U. With a map. Oxford: The Clarendon Press, 1889.

advantages of so narrow a field, and cannot occasionally forbear to comment on occurrences of birds just beyond the border line, which may naturally be judged to belong to one county as much as another, and we heartily commend him for so doing.

Mr. Aplin has been able altogether to note the occurrence of 242 species of birds. To these, perhaps, may be added six other, the appearance of which is considered doubtful. Of this number no less than 103 have been known to breed within the county in the present century. Some few, as the Kite, Buzzard, Harriers, Raven, and Bittern, have now become extinct as breeders; and it is more than probable that the Redshank, Snipe, and Black Tern also bred at one time amongst the swamps of Otmoor, before enclosure and drainage drove them away.

Of the purely raptorial birds ten are included in Mr. Aplin's list. Of these, three, the White-tailed Eagle, Osprey, and Iceland Falcon, must be considered only as chance occurrences, just as likely to be seen in one county as another. The Peregrine Falcon appears to occur regularly as a winter visitor. It is known that a considerable number of Peregrines visit England in the autumn, and take up their quarters in localities which are favourable for a regular supply of food, this appears chiefly to consist near the coast of various waders and ducks, and in the interior of wood pigeons, and sometimes a tame dove from some neighbouring cote; Mr. Aplin records one killed in the act of striking down a pigeon.

It is not improbable that the Hobby nests in Oxfordshire in more than one locality. This most graceful and beautiful little long-winged falcon feeds mainly on insects, a fact which should be recognised by gamekeepers, a body of men, considering their opportunities, often the most ignorant of the economy of our native birds, as they are the most ruthless in destroying them. That a bird is a hawk or an owl, or that it has a general resemblance to either, is quite sufficient to justify its destruction; and thus it is, year by year, England becomes dispeopled of her fair inhabitants in fur and feather—the once beautiful denizens of our woods and forests. We are glad to see that our author in his charming topographical sketch of the county dwells so strongly on this subject, and invokes the protection of landed proprietors in favour of these and other harmless birds. Previous to 1830 the Kite nested regularly in some of the larger woods, but probably became extinct during the next ten years, and Mr. Aplin has collected a considerable amount of evidence, oral and documentary, in connection with its former abundance.

It is not improbable that as late as forty years since the Common Buzzard nested regularly at Stanton Harcourt. Recent notices of this, as well as the Rough-legged Buzzard, are restricted to "trappings and shootings." In 1838 a pair of Honey Buzzards made an attempt to nest in Wellgrove Wood; the nest, however, was plundered, and the old ones destroyed by keepers, an unnecessary piece of cruelty, as it is well known these birds during the summer and autumn feed chiefly on the larvæ of wild bees and wasps as well as the insects themselves. The Marsh, Hen, and Montagu's Harriers are now only rare and occasional visitors, although there can be no doubt that the two first were resident and nested forty to fifty years ago.

Of the owls, the Tawny or Wood Owl appears to be by far the most abundant; its food consisting mainly of rats, moles, mice, shrews, voles, insects, and small birds. Mr. Aplin says it is especially partial to the dor-beetle. The Long-eared Owl is so common a species in the eastern counties, receiving considerable accessions by migration in the autumn, that we are surprised to find it described as a scarce resident. It is pleasant to learn that the useful Barn Owl, notwithstanding constant persecution from the ignorant, is yet fairly common; the author mentions the miserable fact that he has seen as many as fifteen in the shop of one bird-stuffer in May. No wonder that we hear of plagues of rats and mice in various parts of the country. The grey and rufous races of the Short-eared Owl have been recognised in the county, the former of these representing the Arctic, and the latter the more southern form. During the period of migration this rufous-tinted bird appears most to prevail in our eastern counties. Like the other members of its class, this also is destroyed wherever met with, and it cannot be too widely known that it feeds almost exclusively on small mammals, and occasionally little birds, during its stay in this country.

The occurrence of the Grey Shrike in Oxfordshire as late as April 7th is suggestive of it remaining to nest; this is, however, we have observed, just the time they appear to approach the coast on their spring migration. It is somewhat remarkable that the race known as Pallas's Shrike (*Lanius major*), in which there is no white on the secondaries, has so far not been recognised, as on the east coast during the autumn both forms or races appear to be equally common. The Pied Flycatcher is a passing visitor in the spring, on its way to its nesting quarters. On the east coast, at Spurn and Flamborough Head, it occurs often most abundantly during the first week in May, in company with Redstarts.

That richly coloured bird, the Golden Oriole, has been shot in May, under circumstances which leave little doubt of its intention of nesting in the county. It is curious to find a pair of Dippers—birds of the swift-flowing streams of the west and north—nesting in Oxfordshire. In May, 1876, a pair nested at Claydon, and, as a natural consequence of their temerity, were both shot and their eggs taken. The Mistletoe-thrush in Oxfordshire is locally known as the “Norman Gizer,” or Norman Thrush, a name which the author thinks may have been conferred on the bird from a common belief that it first appeared in this country with the Normans, and his further remarks seem very fairly well to bear out this theory. In Craven, in Yorkshire, this bird is also recognised as the Norman Thrush. The Nightingale seems very partially distributed, Mid Oxon and the Thames Valley being its most favourite districts. The Black Redstart, is an occasional visitor; it is now recognised as not of very unfrequent occurrence in the autumn, on migration, occurring about four weeks after the departure of the common Redstart.

Mr. Aplin's remarks on the Marsh Warbler, a species only recently recognised in Great Britain, are very interesting. In 1886, a nest and eggs, now in the British Museum, was taken near Broughton Grange. The bird's very close resemblance to the Reed Warbler is such that it might readily be overlooked. Another rare bird is the Dartford Warbler; it has been observed at least on two occasions, and the nest and eggs taken. From its very shy and retiring nature, it might also be easily passed over.

There can be little doubt that the now rare and beautiful Bearded Titmouse, or Reedling, once haunted the reed beds along the Thames Valley; it has occurred as a wanderer as late as in 1883.

Of the four species of Wagtail recorded by Mr. Aplin, the white, the Continental representative of our pied bird, has been recently detected in the county. The Grey Wagtail—during the nesting season a bird of the mountain stream—has been seen on several occasions in summer, and the evidence seems quite sufficient as to its remaining occasionally to nest. The Woodlark, as is the case in other counties, is of extremely local distribution.

The Grey Crow, Snow Bunting, Twite or Mountain Linnet, so plentiful during the winter in the east coast districts, rarely wander so far westward as Oxfordshire; in fact, it is doubtful if the Twite has been recognised. We have once seen an example of the Grey Crow shot as far west as the border of Monmouthshire. The Brambling, another winter

visitor to the east coast on migration, and of somewhat irregular occurrence, spreads far inland in great flocks; on the wing they much resemble Bullfinches, and the resemblance is heightened by their white rump. Mr. Aplin remarks that nine-tenths of the birds shot are males, and a very large percentage of these adult birds. This quite bears out our own observation on the east coast of England, where we have seen in the autumn flights from 500 to over 1,000, presumably almost entirely composed of males.

The Hawfinch has increased considerably in recent years. It is quite possible our local birds may receive considerable accessions in the autumn from the south-eastern countries on the Continent. It occurs as an irregular migrant at Heligoland. Mr. Aplin has many interesting remarks on the domestic economy of the Hawfinch; the ease with which it will extract the kernels of stone fruit, at the same time rejecting the pulp, is remarkable. The Lesser Redpole appears to nest rather sparingly and locally in this county. The Arctic or Mealy Redpole, the true *Linota linaria* of Linnæus, has so far not been recognised as occurring.

We are glad to see that our author has spoken a word in favour of the useful Starling, in connection with its great services rendered to the farmer and gardener.

JOHN CORDEAUX.

(To be continued.)

NOTES ON A TRIP TO THE ORKNEY AND SHETLAND ISLES, AND ON SOME SINGULAR WATER-WORN ROCKS IN ORKNEY.*

BY W. P. MARSHALL, M.I.C.E.

The Orkney and Shetland Isles extend 170 miles beyond the northern extremity of Scotland, and have a distance of 50 miles of open sea intervening between them, each of them consisting of a group of islands. They present, in several points, a striking difference from the mainland; they have a milder climate, notwithstanding their northern position, on account of being completely immersed in the Gulf Stream, and the temperature is greatly equalised throughout the year by the surrounding water. The climate is considerably warmer in winter than in Scotland, and ice and snow are but little known.

These islands are, however, exposed to violent gales from the Atlantic, and very destructive action of the sea upon the coast, especially on the western side. The result is, very

* Read before the Birmingham Natural History and Microscopical Society, 15th October, 1889.

bold rock scenery on the coast, which is very picturesque and interesting; and the islands are remarkably cut up by numerous fiords, like the opposite coast of Norway on a smaller scale. Geologically there is a marked difference between the two groups of islands; the Orkneys consist principally of Old Red Sandstone, but the Shetlands are almost entirely Silurian slate, with large exposed surfaces of granite. The principal island of the Shetlands, named Pomona or Main Land, is fifty miles in length, but cut up into a most fantastic outline; and at one part it is only half a mile in width, and a small town, Brae, stands on the narrow neck of land connecting the two portions, having two harbours, one in the Atlantic on the west, and the other in the North Sea, on the east coast.

The result of the prevailing high winds is an almost total absence of trees, and there are none at all in Shetland, although there are fuchsias to be seen growing freely out of doors throughout the year. The inhabitants are not Scotch, but have a Norsk element in them, and seem to consider themselves of a race rather superior to the Scotch. Their main occupations seem to be, the men fishing and farming, and the women spinning and knitting. We saw great quantities of the well-known Shetland wool work going on in the cottages, the wool being grown, spun, and knitted on the premises. Fish is, of course, one of the principal articles of diet, but somewhat curiously the inhabitants do not eat either eels or mackerel; they do not consider these good for food, and throw away the mackerel when caught. It may be mentioned that the old name Zetland is used by the inhabitants in preference to the more modern spelling, Shetland.

The Orkneys and Shetlands are easy of access by coasting steamers, that run regularly, and are very comfortable and convenient, affording a very pleasant and enjoyable trip along the coast and amongst the islands. I sailed from Edinburgh with my son direct to Lerwick, the capital of Shetland, calling on the way at Aberdeen and Wick on the mainland, and at Kirkwall, the capital of Orkney. Then, after a day's excursion in a sailing boat to visit some remarkable rocks, we crossed the island to Scalloway, and took a trip by a coasting steamer along the western side of the island, which has the finest rock scenery, calling at several places, including the town of Brae, that stands on the narrow neck of land dividing the island. We then went south by the steamer to Stromness, the second principal town in Orkney, from which some interesting excursions were taken by land and water, and finally left by steamer direct for Liverpool, calling at Stornoway in

the Hebrides and at Oban; thus sailing all round Scotland from Edinburgh, and on to Liverpool. The whole fortnight's trip was very pleasantly varied by the several alternations of a couple of days on the sea, with a stay on shore between them.

The captains of the steamers complain of the absence of lighthouses along the west coast of Shetland. A reason for this is given in Walter Scott's "Pirate," which is not very creditable if true. It is said there that soon after the lighthouses were placed on the Pentland Skerries, two small islands lying between Orkney and the mainland, the islanders of the neighbourhood fell off in their rents because there was no longer the spoil from wrecks. It is to be hoped this was a libel; still it is certain that the ancient Shetlanders looked upon wreckage as legitimate prey, and that there was formerly a superstition that whoever saved a drowning man would suffer a future injury from him. The unfortunate fact remains that to this day there are no lighthouses along that coast.

The principal objects of interest in Kirkwall, the capital of Orkney, are St. Magnus Cathedral, parts of which date from the beginning of the twelfth century, and the ruins of the Bishop's Palace and the Earl's Palace. The latter was built by the notorious Earl Patrick Stewart, and is well described in the "Pirate." The older parts of the town are picturesque, the streets are very narrow, and paved all across with flags, with no distinction between the horseway and footway except a narrow track of pitching in the centre only about a yard wide. Kirkwall has a subsidiary port called Scapa on the opposite coast, about a mile and a half distant.

From Lerwick, the capital of Shetland, a fine day's excursion in a sailing boat was made to the eastern extremity of the rocky island Noss, where there are extensive bird rocks, a breeding ground for great swarms of birds. One special rock, the "Holm of Noss," is detached from the island by a narrow channel, that can be sailed through in very calm weather; with both sides formed of vertical faces of rock rising direct from the sea, and in some parts having the top overhanging the base. One part of the rock face, beyond the Holm, forms a promontory called the "Noup of Noss;" this is 600 feet in height from the sea, and we got to the top of it overland.

There are several caves in the rocks along the coast; the largest one "Orkneyman's Cave," we rowed into for a distance of about 250 yards, through a winding passage lighted by a torch; the cave then becomes too narrow for the boat to enter further, but a small canoe is said to have been once taken on for a distance of 100 yards further.

In reference to the birds breeding on the rocks, the sailors said they had frequently seen the young Guillemots dropped down into the sea on the back of the mother bird for their first sea bath, and the young bird was held securely in its position by the beak of the mother, who turned her head back over her shoulder to catch hold of the young bird with her beak. There have been shown engravings with the young bird calmly sailing down on the back of the mother without any such hold; but that certainly seems improbable. There was a discrepancy in the accounts of the sailors, as to the time in the young bird's life when its first plunge was taken; one account was that this was directly after hatching, as a protection from the depredations of large gulls that prey upon the young birds; but another account, which seemed more probable, was that the first plunge is some time after hatching, when the young bird is able to fly up again, and repeat the performance on its own account.

In reference to this interesting question, Mr. Waterton says (as stated by Macgillivray, Vol. II., page 322), "The men about Flamborough Head assured him that when the young Guillemot comes to a certain size, it manages to climb upon the back of the old bird, which conveys it down to the ocean." Macgillivray adds, "Others say the old Guillemot takes her chick by the neck in her bill, and thus conveys it to the sea."

Yarrell (Vol. IV., page 72), quotes Mr. Maclachlan, "who asserts that the young bird is grasped by the wing, near the shoulder, and is not as a rule, carried down on the back of the parent."

Seebohm (Vol. III., page 398) says, "That young birds, totally incapable of flight, are seen on the sea is an undisputed fact, but the means by which they get there is the vexed question. Many ornithologists believe that the young bird is conveyed to the water below by its parent; and the veteran climber, Lowney, positively assured me that he had seen the old bird in the act of conveying her young down to the sea on her back. About half-way down the little creature slipped off; the mother flew round and round it, screaming as if in alarm; but the young bird swam away all right, and did not seem injured by the fall."

I am indebted to Mr. Chase for the above interesting quotations; and he adds that, from his own personal observation of the habits of the Guillemots at their breeding stations, he "cannot give credence to these accounts of conveying the young to the sea; and it is curious that no naturalist should have witnessed the performance, and that the only

foundation for such assertion rests upon accounts furnished by fishermen and climbers, who always take delight in the wonderful. All I can say," adds Mr. Chase, "is that it is not impossible for the parent to act as stated, but I have never seen the operation."

Bressay, the island facing Lerwick harbour, is the great breeding place of the Shetland ponies, which, by the way, are now getting very scarce, being bought up by the Americans as fast as they can be reared.

Scalloway, the ancient capital of Shetland, is picturesquely situated; it is principally interesting as containing the ruins of the notorious Earl Patrick Stewart's castle. High up on the castle wall an iron ring is shown, from which the earl used to suspend his victims; an eminence in the neighbourhood bears the suggestive name of "Gallows Hill." Scalloway is a great fish-curing place, and whole stacks of dried and salted fish are seen piled up by the roadside.

Stromness is perhaps the most picturesque town in Orkney, and the best centre for excursions. From this place a sailing boat was taken to the "Old Man of Hoy," a remarkable and unique detached pinnacle of rock, no less than 450ft. high, standing up direct from the water's edge. It is a very picturesque object, a jagged obelisk of old red sandstone about 70ft. square at the base and reduced to half the thickness at the top. This remarkable pinnacle bears a close comparison in height with the highest cathedral spires, Strasburg 460ft. and Rouen 490ft., and the Great Pyramid 480ft. high.

An interesting land excursion from Stromness was to a large stone circle, about 300ft. in diameter, supposed by some to be Scandinavian, not Druidical; it is called the "Standing Stones of Stennis," and forms a scene in the "Pirate." It may be mentioned that nearly all the spots so graphically described in the "Pirate" were visited, and with a special interest, and the wild headland was seen that was held by "Norma of the Fitful Head." Near Stennis was also seen an interesting tumulus, "Maeshowe," which contains a stone chamber that can be entered, and has some Runic inscriptions on the walls.

Near Scail, on the west coast, seven miles north of Stromness, there occur some singular water-worn rocks that are of much interest; these are at the top of a cliff, about 80ft. in height, rising direct from the sea, and form a portion of a thin stratum on the surface of the ground that extends nearly a mile along the coast. This stratum is at a slight inclination, sloping towards the sea, and shows irregularly for a few hundred feet distance inland from the edge of the

cliff, beyond which the ground is covered with grass, and rises gently for a mile or two further inland. The stratum is a light-coloured sandstone, split up at the surface into thin layers of an inch or two thickness, which are broken up and lie scattered as loose shingle in irregular groups over the solid rock. These loose pieces are seen, at some parts, to have a more finished and symmetrical appearance, with moulded edges, and further on an exposed surface of the rock is seen, marked out with irregular crossing lines, ready for splitting up into the loose pieces seen; and at last a place is met with where these markings become definite moulded grooves, dividing up the surface of the rock into approximately symmetrical figures, and presenting a striking resemblance to a tessellated pavement, with tiles of about four to eight inches in size, and sometimes as large as a foot in length. This resemblance to an artificial pavement is rendered still more striking by the several "tiles" being separated by very regular jointing lines of about an inch in width, of a lighter colour than the "tiles," and depressed about a quarter of an inch below them, giving so distinct an appearance of a cement joint that it is very difficult at first to conceive the whole is not an artificial pavement of tiles, set in cement. This difficulty is increased by the circumstance that each "tile" is bordered by a really well finished moulding, which is carried uniformly round all the edges of the "tile," and in several cases there is a second moulding parallel to the first one, and sometimes a third smaller one. A section shows the lower one with two mouldings, and the upper one with three mouldings; a marked correspondence is shown between them as regards the two outer mouldings, and the third inner one has the appearance of being formed out of the edge of the main centre portion, suggesting a successive formation of these parallel mouldings from the outside inwards.

The more general form of the "tiles" approximates to a lozenge shape, most frequently with one of the angles rounded off; but one example is a nearly perfect lozenge, having sides of from 3 inches to $4\frac{1}{2}$ inches in length; and a general feature of them is that the "tile" is darker coloured than the intervening "cement" portion. Some of the "tiles" are darker than the others, and in those the darker portion generally stands out more prominent, and has rounded edges, with a deep groove cut in all round, and separating it from the first moulding. Then in other specimens that may be termed further advanced, there is seen a tendency to the dark centre portion becoming undercut at the edges, and at last specimens are found where the centre has become actually detached, and has the appearance of a "nodule of ironstone;"

and it is considered that the nucleus of each of the "tiles" is really a nodule of ironstone, in various stages of formation, or rather of concentration. Some of the specimens are argillaceous at the under side, and siliceous only at the upper face.

The whole rock is an iron-coloured sandstone, and it is suggested that in the first place the surface became cracked and cross-jointed by a process of shrinkage, and then each of the so-formed "tiles" would be subjected to the action of surface water (the surface drainage of the sloping land), trickling down through the little channels of division between the tiles. There is found to be a tendency in such isolated patches of sandstone, uniformly impregnated with oxide of iron, for the iron to become gradually concentrated towards the middle of the patch, by some kind of molecular attraction, deserting the margin, which becomes consequently light coloured, and migrating towards the centre, which becomes dark-coloured and ultimately converted into a nodule of ironstone. Such is considered to be a frequent process of formation of ironstone nodules, although the mode of action and the operating force are not yet understood.

I am indebted for these suggestions to Dr. Lapworth, who has kindly examined these specimens, and was much interested with them. The further question of the mode of formation of the mouldings round the nodules, and particularly where there is a succession of two or more mouldings, offers much difficulty, and is one of much interest for consideration. It has to be noticed that in several of the specimens there is an appearance of a succession of layers, in the form of saucer-shaped hollows lying one within another, and having the edges of the layers cropping out round the margin in parallel lines, suggesting a possible connection with the parallel mouldings that surround the centre nucleus.

Dr. Tilden, who has also kindly examined the specimens chemically, finds "they all contain carbonate of lime, though in very different proportions; mere traces appear in the interior, but there is a good deal in the argillaceous material of which the lower part consists in most of the specimens. Under the microscope the shining specks look like bits of mica; they are iridescent, and apparently weathered." He suggests that "possibly the rock originally consisted of a sort of marl containing some sand, that joints were formed in it by contraction or otherwise, and that the upper part of each lozenge-shaped mass thus produced has been deprived of its carbonate of lime and fine particles of clay by weathering action, leaving the sandy particles behind cemented by oxide of iron. The singular double furrow is a point of curious interest."

CONSTANCE NADEN : A MEMOIR.*

Many readers will remember that in our last volume we published an interesting memoir of Miss Constance C. W. Naden, written by her admiring friend, Mr. W. R. Hughes, F.L.S., supplemented by valuable contributions from Professor Tilden, F.R.S., and Dr. Lewins. This memoir has since been almost wholly re-written and largely added to by communications from some of Miss Naden's most intimate friends, giving many personal reminiscences, the chief of which is a delightfully interesting "Introduction," by Professor Lapworth, F.R.S., which adds greatly to the value of this gratifying memorial of a lady whom Birmingham men will always regard as one of the most gifted of its citizens. The thanks of the community are due to Mr. Hughes for the loving pains he has taken to place within every one's reach an interesting and permanent record of this highly endowed lady, and to Dr. Lewins for having it printed in the dainty volume before us; for it is entirely to him that the publication of this volume is due. To his generosity we owe the beautiful bust of Miss Naden, the "Constance Naden Medal," the lately issued volume, "Induction and Deduction," and the present "Memoir." Dr. Lewins also intends to publish another volume of Miss Naden's Essays.

HISTORY OF THE COUNTY BOTANY OF WORCESTER.

BY WM. MATHEWS, M.A.

(Continued from Vol. XIII., page 259.)

The Botany of Worcestershire, by Mr. Edwin Lees, was published at Worcester in 1867. It embodies the labours of the Botanists of the Worcestershire Naturalists' Club, extending over a period of twenty years, and is the first attempt to record all the plants of the county.

The book commences with an Introduction, pp. i. to xci., arranged under the following heads:—

- v. Limitation of species to particular localities.
- x. Sudden appearance of plants in particular places.
- xvii. Naturalised and introduced plants.
- xxiii. Plants of early introduction to England.
- xxvii. Modern immigrants and garden stragglers.

*Constance Naden : A Memoir. By W. R. Hughes, F.L.S., with an introduction by Professor Lapworth, LL.D., F.R.S., and additions by Professor Tilden, D.Sc., F.R.S., and Robert Lewins, M.D. London : Bickers and Son ; Birmingham : Cornish Brothers.

- xxviii. Plants not truly native, introduced designedly or furtively.
- xxxii. Plants becoming rare or extinct.
- xxxiii. Conspicuous vegetation.
- xxxvii. Old forest trees.
- xli. Critical plants.
- liii. Census. Flowering Plants, Ferns, and Characeæ, 992.
- lxiv. Physical geography.
- lxxii. Rainfall and temperature.
- lxxvi. Rainfall.
- lxxx. Winds and their effects.
- lxxxii. Worcestershire compared with Herefordshire.
- lxxxviii. Worcestershire Botanists and Botanical authors.

Under the head of critical plants, p. xli., Mr. Lees describes, *inter alia*, *Valerianella eriocarpa*, Desv., gathered by him on the 29th August, 1842, by the side of the road between New Pool and Hanley Turnpike Gate, below Malvern Wells. This plant is noted in the 1st edition of the Botany of the Malvern Hills, 1843, as *Fedia mixta*, and in the 2nd edition, 1852, as *Fedia dentata*, var. *mixta*.

The above is the only occasion on which the plant has been seen in Britain. See Bot. Mal. Hills, 3rd edit., p. 44; Bab. Man., 5th edit., 1862, p. 165; Syme E. Bot., 3rd edit., Vol. IV., 1865, p. 244. The first notice of the plant as *V. eriocarpa* was probably by Babington in 1862.

The second part of the work is entitled "The Local Distribution of the Plants of Worcestershire," and occupies the pages from 1 to 147. The author divides the county into four Botanical districts, viz. :—

1. The Severn Valley.
2. The Malvern Hills and Valley of the Teme.
3. The Avon and Lias Country.
4. Bromsgrove Lickey and the intervening district to Birmingham, Halesowen, Stourbridge, and Dudley.

The author describes the most interesting Botanical localities in each district, and the rarer plants which occur in them.

The third is a tabulated list of all the plants in each Botanical district, with an appendix on the Rubi, pp. 1 to 48.

This is followed by three pages of Additions and Corrections.

List of the principal plants noted in Lees's Botany of Worcestershire. District is denoted by the letter D. The four districts are contracted into Avon, Severn, Malvern, and Lickey :—

† *Anemone Pulsatilla*. 104, Avon. Snowhill, Gloucester. Tab. 3.

† *A. apennina*, xxviii. Tab. 3. *Not native*.

† *Adonis autumnalis*, lviii. Tab. 3. *Marked as extinct*.

Ranunculus cænopus (Lenormandi). Tab. 3. Lickey district. *No locality given*. Not noted elsewhere in volume.

- * *R. Lingua*. Additions and corrections. Pool at Spetchley.
- † *Eranthis hyemalis*, xxviii. Tab. 3. Marked as "occasional" in each district. *Not native*.
- * *Helleborus viridis*. 86, Malvern D. *No locality given*. 115, Lickey D.; wood at Frankley.
- * *Helleborus fætidus*. 86, 135, Malvern D. *No locality given*. Tab. 3.
- * *Aquilegia vulgaris*. 6, 18, Severn D.; 67, 86, Malvern D.; 114, 116, Lickey D. Tab. 3.
- * *Delphinium Consolida (Ajacis)*, xxviii. 93, Avon D.; 93, 116, Lickey D. Tab. 3. Marked as extinct in each district.
- * *Aconitum Napellus*, vii. 85, 135, Malvern D. Tab. 3. *The reference in each instance to the locality at Eastham, near Tenbury.*
- * *Berberis vulgaris*. 39, Severn D. Same locality as in *Hast. Ill.*, 160. Also noticed in x., xix., xxxii.
- † *Epimedium alpinum*. In shrubberies, near Tewkesbury, xxviii. Tab. 3. *Not native. In Gloucester.*
- *† *Nymphæa alba*, xxviii. *Not native to Worcestershire.*
- * *Papaver hybridum*. 39, Severn D. In a calcareous cornfield at Tibberton, about three miles on the eastern side of Worcester. Tab. 3.
- P. Lecoqii*. Additions and Corrections. Old limestone wall near the Berrow Church, Malvern.
- *† *P. somniferum*, xxviii. Shore of the Severn at Worcester. *Not native.*
- Glaucium luteum*, xxviii. Tab. 4. Avon.
- *† *Corydalis solida*, xxviii. Tab. 4. *Not native.*
- * *C. lutea*, xxviii. Tab. 4.
- * *C. claviculata*. 6, Winterdyne, Bewdley; 12, Habberley Valley; near Park Hall, Kidderminster; 65, Malvern Hills; 114, Bromsgrove Lickey. Tab. 4. Severn, Malvern, Lickey.
- * *Fumaria capreolata*. *Aggregate*. Tab. 4. Severn, Malvern, Lickey.
- * *Cheiranthus Cheiri*, xxviii., 124. Tab. 4. In all the districts.
- * *Nasturtium sylvestre*, xxxv., 4, 28. Tab. 4. Avon, Severn, Malvern D.
- * *Barbarea præcox*, xxviii. 39, Severn D.
- * *Hesperis matronalis*, lxxxiv. 86, Malvern D. *No locality*. 115, Lickey D. *No locality*. Tab. 4. Severn, Malvern, Lickey, D.
- * *Sisymbrium Sophia*, xxvi., lxi., 12, about Kidderminster; 39, Northwick, near Worcester, T. Westcombe; 59, near Kidderminster and Stourport. Tab. 4. Severn D. only.
- * *Erysimum cheiranthoides*. 39, "Banks of Severn, near Hallow;" *Herb. Worcester Museum, Addit. and Corr.*; near Stone; Tab. 4. Avon, Malvern, Lickey, D.
- *† *Sinapis alba*. 103-5, Snowhill. *This locality is in Gloucester.*
- Alyssum calycinum*, xxix. Railway embankment, Astwood; near Worcester, Mr. T. Baxter. Tab. 5. Severn. *Not native.*
- * *Königa maritima*, xxix. Severn shore at Worcester and near Malvern. Tab. 5. *Not native.*
- * *Armoracia rusticana*. Tab. 5. In all the districts. *Not native.*
- † *Camelina sativa*. Tab. 5. Severn, Malvern, Lickey. *Not native.*

- Thlaspi perfoliatum*, vi. Has been found actually located at Evenlode, an isolated portion of Worcestershire, 104-5; Hyate's Pits, Snowhill, near Broadway; Mr. Cheshire. *This locality is in Gloucestershire.* Evenlode; Mr. Cheshire. Tab. 5. Avon D. only.
- * *Teesdalia nudicaulis*, 12, 60. Tab. 5. Avon, Severn, Malvern.
- * *Iberis nudicaulis*, 95. *There is some confusion here. Mr. Lees refers to I. nudicaulis in Nash's List. See "Mid. Nat.," Vol. X., p. 122. But I. nudicaulis, Linn. = Teesdalia nudicaulis, Robt. Brown. I. nudicaulis is not in Tab.*
- ‡ *Iberis amara*, xxix. About Malvern, here and there sparingly. Tab. 5. *Not native to Worcestershire.*
- * *Lepidium Draba*, xxix., 20. Powick Bridge, Worcestershire. Tab. 5. Malvern. *Not native.*
- * *L. ruderale*, 36. Droitwich. Tab. 5. Severn.
- * *L. latifolium*, 37. Droitwich. Tab. 5. Severn.
- * *Senebiera Coronopus*. Tab. 5. In all the districts.
- ‡ *Isatis tinctoria*, 28, 61, 137. The Mythe, near Tewkesbury. Tab. 5. Severn. *In Gloucestershire.*
- * *Raphanus Raphanistrum*, 74. Tab. 5. In all the districts.
- * *Reseda lutea*, lxi. Noted in Avon D., 98; Alderminster, Mr. Cheshire, 100; Bredon Hill, 103; Broadway Hill, 133; Dudley Castle. See Ed. Lees, in New Bot. Guide, "Mid. Nat.," Vol. XI., p. 278. Tab. 5. Avon, Lickey.
- *‡ *R. suffruticulosa*, xxix., 39. Waste ground, Britannia Square, Worcester. *Not native.*
- * *Helianthemum vulgare*. Tab. 5. In all the districts.
- * *Viola palustris*, 11, 12, 60., Severn D.; 114, 119, 120, 138, Lickey D. Tab. 5.
- * *V. pumila*, Fries., *V. flavicornis*, Sm. = *V. canina*, L. 12, Hartlebury Common. 67, Malvern. Tab. 5. In all the districts.
- * *Drosera rotundifolia*. 12, 60, Severn D.; 66, Malvern D.; 114, 119, 120, Lickey, D. Tab. 6. *Mr. Lees has omitted to notice Perry's records of this plant on Falling Sands Common, near Kidderminster, and at the Devil's Spittleful, near Bewdley, published in Loudon's Magazine, 1831. See "Mid. Nat.," Vol. X., p. 256. Gathered by the writer in both these localities in 1885. Falling Sands Common is now enclosed, and forms part of Oldington Plantation.*
- * *Polygala vulgaris*. Tab. 6. In all the districts. *Not differentiated from P. depressa, Wend.*
- * *Dianthus prolifer*, xxix., lxxxviii. Table 6. *Reference to Ballard's record, see "Mid. Nat.," Vol. X., p. 151.*
- * *D. Armeria*. Noticed in Severn district at p. 40, yet in Tab. 6 assigned to the Avon, Severn, and Malvern Districts.
- * *D. deltoides*. 12, 60, Severn D.; 119, Lickey D. Tab. 6.
- * *Saponaria officinalis*. 6, 22, 40, Severn D.; 115, Lickey D. Tab. 6.
- * *Silene anglica*, xc. Arley, near Stourport. Purton, *fide* Mrs. Gardner. "Mid. Nat.," Vol. X., p. 255, 12. Mentioned in Scott's History of Stourbridge, but not to be found at present. *Mr. Lees was mistaken. It is not mentioned in Scott. It was, nevertheless, gathered by the writer in a field at Churchill, in 1879. Sp.!* Tab. 6.

- * *S. conica*, 12, 15. Tab. 6. "Now extinct." *This is Scott's record.*
See "Mid. Nat.," Vol. XI., p. 17.
- Sagina ciliata*, 12. Severn D. Blakedown. *Recently gathered at Hagley Brake.* Tab. 6.
- * *S. nodosa*, 69. Malvern Hills. Tab. 6.
- * *Alsine tenuifolia*, 105. Hyate's Pits, Mr. Cheshire. *Gloucestershire.*
See Ballard, "Mid. Nat.," Vol. X., p. 151. 119, Lickey D.;
Yardley, Miss Beilby. *An error?* Tab. 6.
- * *Arenaria trinervis*. Tab. 7. In all the districts.
- * *A. serpyllifolia*. Tab. 7. In all the districts. *Not differentiated from A. leptoclados, which occurs in many places.*
- *† *Stellaria nemorum*, 59. Severn D. Wyre Forest. *No authority; no exact locality. An error?* 119, Lickey D. Yardley, Miss Beilby. *An error?* Tab. 7.
- [*S. glauca*. Tab. 7. In none of the districts. *Recorded, nevertheless, by Purton, on the authority of Mr. Hickman, in the Appendix to the Midland Flora. See "Mid. Nat.," Vol. X., p. 255. Gathered by the writer in 1890, near the head of the Ladies' Pool, Blakedown. Probably widely distributed, but much rarer than S. graminea.*]
- * *Cerastium aquaticum*. 12, Severn D.; 119, Lickey D. Tab. 7. In all the districts.
- * *C. semidecandrum*. 60, Severn D. Hartlebury Common. Tab. 7. In all the districts.
- * *C. arvense*, lxi., Severn D.; 106, Avon D.; Broadway Hill, Mr. Cheshire. *See Purton, "Mid. Nat.," Vol. X., p. 221. The Severn D. locality is not mentioned at p. lxi. Sutton Common, near Kidderminster, is probably the place intended, where this species grew abundantly until 1876, Sp. ! Soon after this date the common was ploughed up. I have specimens from the neighbourhood, gathered by the late Rev. J. H. Thompson in 1883, and by Dr. F. Arnold Lees in the same year.* Tab. 7. Severn D. only. Avon D. omitted, I presume, accidentally.
- * *Mœnchia erecta*. 6, Severn D.; Spring Grove, Bewdley; 65, Malvern D.; Malvern Hills; 125, Lickey D.; Clent Hills. Tab. 7. All the districts except the Avon.
- * *Spergularia* (*Lepigonum*, *Arenaria*, *Alsine*) *rubra*. 65, Malvern Hills; 126, Winwood Heath, now enclosed. Tab. 12. Severn, Malvern, Lickey districts. *Frequent in sandy places in the north of the Severn D.; between Hagley and Kidderminster; Clent Hills, &c., Sp. !*
- * *S. neglecta*, Syme. 33, Severn D.; Saldon, as *Alsine media*, *should be in Avon D.*; 37, Severn D.; Droitwich Canal; 91, Avon D.; Defford Common. Tab. p. 12.
- * *Montia fontana*. 65, Malvern D. Tab. 12. All the districts except the Avon.
- * *Elatine hexandra*, ix. Tab. 6. Severn D.
- * *E. Hydropiper*, ix. Tab. 6. Severn D.

(To be continued.)

BOTANICAL NOTES FROM SOUTH BEDS,

WITH VOUCHER SPECIMENS.

The earliest observed dates of the flowering of the species enumerated below are as follows:—

NAME	DATE.	ASPECT.	SITUATION, &c.
Corylus Avellana ..	1889. Dec. 25	Open	Hill top. Pistillate flowers only
Ditto ditto ..	1890. Jan. 12	„	Same station. Both male and female plentifully.
Mercurialis perennis ..	„ 12	N.E.	Shrubbery. Inflorescence only
Ditto ditto ..	„ 26	Open	Meadow. Male flowers only.
Petasites vulgaris ..	„ 26	„	Meadow. Several plants in blossom.
Tussilago Farfara ..	„ 26	W.	Railway bank. One blossom.
Ditto ditto ..	Feb. 1	S.W.	G. N. R. bank. Several blossoms.
Ranunculus Ficaria ..	„ 9	Open	Meadow. One blossom.
Prunus spinosa ..	„ 23	„	A few poor blossoms.
Cardamine hirsuta ..	Mar. 9	W.	Brook side. Fairly abundant.
Ranunculus Ficaria ..	„ 9	Open	Same station as above, and only fairly abundant till this date.
Salix caprea ..	„ 16	„	Coppice. Both sexes in blossom
Anemone nemorosa ..	„ 29	„	Plentiful.
Viola Riviniana *	„ 29	W.	Hill side.
Nepeta Glechoma ..	„ 30	S.W.	Bank.
Prunus spinosa ..	„ 30	Open	Fairly abundant by this date.
Caltha palustris ..	„ 30	„	Meadow. Two blossoms.
Equisetum arvense ..	Apr. 20	„	Hill side.
Prunus avium ..	„ 27	W.	Hill side. Plentiful.
Scilla nutans ..	May 4	Open	Meadow.
Sisymbrium Alliaria ..	„ 4	W.	Railway bank. Plentiful.
Ranunculus auricomus ..	„ 4	Open	Meadow. Plentiful.
Carex glauca ..	„ 4	N.W.	Hill side.
Barbarea vulgaris ..	„ 11	S.W.	Brook side.
Cratægus monogyna ..	„ 14	Open	Hedge.
Sanicula europæa ..	„ 18	„	Spinny.

J. SAUNDERS, Luton.

*The voucher specimen enclosed was *Viola hirta*.—EDS. "Midland Naturalist."

THE FUNGI OF WARWICKSHIRE.

BY W. B. GROVE, M.A., AND J. E. BAGNALL, A.L.S.

(Continued from Vol. XIII., page 282.)

442. *R. foetens*, Fr. Woods and roadsides. Sometimes fragrant. Oct. Warwick, *Perceval*. Crackley Wood and The Briars, Kenilworth, *Russell*, *Illustr.* Ansty, *Adams*. School Close, *Rugby Sch. Rep.* Water's Wood, Maxstoke; Kingsbury Wood; Trickley Coppice; Solihull; Sutton Park; Berkswell; Fen End; Edgbaston Park; Coleshill Pool; Packington; Stoneleigh Abbey; Sperrall.

443. *R. fellea*, *Fr.* Woods. Rare. Borders of Upper Nuthurst, Sutton Park! *Dr. Cooke.* Combe, *Adams.* New Park; Four Oaks; Bradnock's Hayes; Edgbaston Park.
444. *R. Queletii*, *Fr.* Pine woods. Rare. Oct. Pine wood, Marston Green, 1882, named by *Dr. Cooke.*
445. *R. emetica*, *Fr.* Woods. Local. Sept.-Oct. Warwick, *Perceval.* Crackley Wood! *Russell, Illustr.* Combe, *Adams.* Baddesley Park, *Hawkes!* Sutton Park; Trickle Coppice; New Park; Shawberries Wood; Kingsbury Wood; Ironstone Wood, Oldbury; woods, Maxstoke; Solihull; Coleshill Heath and Pool; near Harborough Magna; Old Park Wood, near Alcester; Chelmsley Wood; Edgbaston Park, &c.
446. *R. ochroleuca*, *Fr.* Fir woods. Oct. Local. Crackley Wood, Kenilworth! *Russell, Illustr.* Sutton Park; Trickle Coppice; New Park; pine wood, Coleshill Heath; Corley; woods, Maxstoke; Bradnock's Hayes; Marston Green; Solihull.
447. *R. citrina*, *Gill.* Woods. Local. Sept.-Oct. Sutton Park; Trickle Coppice; Water's Wood, Maxstoke; Edgbaston Park.
448. *R. fragilis*, *Fr.* Woods. Sept.-Oct. Birmingham Road, Kenilworth, *Russell, Illustr.* Combe Woods, *Adams.* Sutton Park; Trickle Coppice; New Park; Birch Moor Stump; Maxstoke; Coleshill Pool and Heath; Olton Reservoir; Solihull; Bradnock's Hayes. Var. *violacea*, Trickle Coppice. Var. *alba*, Windley Pool, Sutton Park.
449. *R. integra*, *Fr.* Woods. August to October. Crackley Wood, Kenilworth, *Russell, Illustr.* Ansty, *Adams.* Sutton Park; Trickle Coppice; New Park; Plant's Brook Reservoir; Farley Park, Atherstone; Coleshill Pool; Haywood; Edgbaston Park; Berkswell; Balsall Street; Packington Park; Marston Green; Corley. Var. *alba*, Sutton Park, 1888, *Cooke, Illustr.* 1084.
450. *R. decolorans*, *Fr.* Woods. Sept. Crackley Lane, *Russell, Illustr.* (?) High Wood, Combe, *Adams.*
451. *R. aurata*, *Fr.* *Ag. auratus*, *With.* Under trees. Rare. Oct. Under a large oak near second stew, Edgbaston Park, *With.* 194.
452. *R. veteriosa*, *Fr.* On the ground. Rare. Near Ansty, *Adams.*
453. *R. nitida*, *Fr.* Woods. Rare. Oct. Avenue (Rugby?) *Rugby Sch. Rep.*
454. *R. claroflava*, *Grove.* Very rare. Sept.-Oct. In the marshy wood at the head of Windley Pool, Sutton Park. See *Mid. Nat.*, 1888, p. 265.

455. *R. alutacea*, Fr. Woods. Oct. Warwick, *Perceval*. Kenilworth! *Russell, List*. Ansty, *Adams*. School Close, *Rugby Sch. Rep*. Woods, Sutton Park; New Park; Water's Wood; Maxstoke; Wainbody Wood, Kenilworth; Cornets End, Berkswell; Fen End, Marston Green.
456. *R. lutea*, Fr. *Ag. integer*, var. 6, With. Woods. Rare. Aug.-Sept. Edgbaston Park, *With*. 192. Crackley Wood, *Russell, Illustr*. Combe Ridings, *Adams*! Trickley Coppice.
457. *R. chamæleontina*, Fr. Under trees, Hopsford, *Adams*.

Genus X.—CANTHARELLUS, *Adams*.

458. *C. cibarius*, Fr. *Merulius cantharellus*, With., *Purt*. In woods. Rare. Sept.-Oct. Red Rock Plantation, Edgbaston Park, *With*. 148. Ragley Woods! Oversley Hill and Wood, *Purt*. ii. 621. Warwick, *Perceval*. Crackley Wood, Kenilworth, *Rev. Mr. Knowles*. Combe Woods, *Adams*. Bentley Park, *Bloxam*. Kingswood, *Hawkes*! Coleshill Heath; Shawberries Wood; wood on the Ridgeway, near Coughton Park.
459. *C. aurantiacus*, Fr. *Ag. subcantharellus*, *Purt*. Woods and heathy places. Oct. Studley Common, *Purt*. iii. 184. Hopsford, near Brinklow, *Adams*. Pool Hollies Wood, 1881; Sutton Park; Fen End; Packington Park; Coughton Park, &c. In Sutton Park whitish forms occur on the heathlands; the variety *nigripes* is also common.
460. *C. tubæformis*, Fr. Rare. Sept.-Oct. Bentley Park, 1849, *Bloxam*. The Ridings, Combe, *Adams*. Shawberries Wood, Shustoke.
461. *C. infundibuliformis*, Fr. Woods. Rare. Bentley Park, 1849, *Bloxam*.
462. *C. muscigenus*, Fr. *Merulius muscigenus*, var. 2, With. On moss in Packington Park, *With*. 150.
463. *C. lobatus*, Fr. *Merulius membranaceus*, *Purt*. At Pophills, growing on moss, *Mrs. Rufford in Purt*. iii. 181.

Genus XI.—NYCTALIS.

464. *N. asterophora*, Fr. Woods. Rare. Sept.-Oct. The Ridings, Combe, *Adams*. Wood near Hams Hall, on *Russula nigricans*. [I do not see in this anything more than *N. parasitica*, bearing the conidia of *Hypomyces asterophorus*.—W. B. G.]
465. *N. parasitica*, Fr. *Ag. umbratus*, With. Woods. Rare. Aug. to Oct. Red Rock Plantation, Edgbaston, *With*. 197. Wood, Red Lane, Kenilworth, *Russell, Illustr*. Combe Woods, *Adams*. On decaying *Russula fætens* in Cut-throat Wood, Solihull; New Park, Middleton; Spennall, on *R. nigricans*.

Genus XII.—MARASMIUS. *Fr.*

466. *M. urens*, *Fr.* Woods. Aug. to Oct. Warwick, *Perceval*. Crackley Wood! Kenilworth, *Russell, Illustr.* Combe Ridings! *Adams*. Sutton Park; New Park; Cut-throat Wood, Solihull; The Spring, Kenilworth.
467. *M. peronatus*, *Fr. Ag. peronatus*, *Purt.* Woods, amongst leaves. Oct. Ragley Woods, *Purt. iii.*, 207. Crackley Wood! Kenilworth, *Russell, Illustr.* Combe Ridings, *Adams*. Sutton Park; New Park; Trickle Coppice; Coleshill Heath; Ironstone Wood, Oldbury; Bradnock's Hayes; Sperrall; Packington Park, &c.
468. *M. porreus*, *Fr. Ag. alliaceus*, *Purt.* In woods, amongst leaves. Sept.-Oct. Maxstoke, *Bree in Purt. ii.*, 650. Abundantly in Oversley Wood, 1818, *Purt. iii.*, 421. Crackley Wood, Kenilworth, *Russell, Illustr.* Combe Ridings, *Adams*.
469. *M. oreades*, *Fr. Ag. orcadæ*, *With.* In pastures, forming rings. Aug. to Oct. Not common. Edgbaston, hedge banks, pastures, in small or large patches, particularly in fairy rings, *With.* 218. Warwick, *Perceval*. Dunn's Pits and Dale House Lanes, Kenilworth! *Russell, Illustr.* Ansty, *Adams*. Oscott; Sutton Park; Stonebridge; Maxstoke; Arrow Lane; pastures near Milverton, &c.
470. *M. erythropus*, *Fr.* Woods. Oct. Warwick, *Perceval*. Crackley Wood, Kenilworth, *Russell, Illustr.* *Ag. dispar*, *With.* (Batsch., 210), "In the Park at Packington," p. 273, is a variety of this, if correct.
471. *M. archyropus*, *Fr.* Woods. Sept. Crackley Wood, Kenilworth, *Russell, Illustr.*
472. *M. Vaillantii*, *Fr. Merulius androsaceus*, *With.* On dead wood. Oct. Packington Park, amongst moss, *With.*, 146. [I do not think that Withering's species was anything more than *M. androsaceus*, *Fr.*—W. B. G.]
473. *M. foetidus*, *Fr. Merulius foetidus*, *Purt.* "In my own garden (Alcester). growing between the furrows of the bark," *Purt. ii.*, 620.
474. *M. ramealis*, *Fr.* Hedges and woods. Oct. Burton Green Wood, Kenilworth, 1863, *Russell, Illustr.* Combe Woods, *Adams*. Coleshill Pool.
475. *M. alliaceus*, *Fr. Ag. alliaceus*, *With.* Woods. Rare. Sept. "It has lately been found in woods about Packington," *With.*, 272.
476. *M. rotula*, *Fr. Merulius collariatus*, *Purt.* On woods and twigs. "Shrubbery in my own garden (Alcester)," *Purt. ii.*, 619. Warwick, *Perceval*. The Spring, Kenilworth, *Russell, Illustr.* Hopsford. *Adams*. Sutton Park; Shawberries Wood, Shustoke; Trickle Coppice; Packington Park; Bradnock's Marsh, &c.

477. *M. androsaceus*, Fr. *Merulius androsaceus*, Purt. Plantation at Arrow, *Purt.* ii., 619. Combe Woods, *Adams*. Sutton Park; Marston Green; Maxstoke; Solihull; Olton; Coleshill Pool; Trickley Coppice. &c.
478. *M. epiphyllus*, Fr. *Merulius squamula*, Purt. On leaves, &c. Oct. In the lane from Oversley to the mill; Arrow, &c., *Purt.* ii., 620.
479. *M. saccharinus*, Fr. Woods. Rare. Aug. Crackley Wood, Kenilworth, *Russell, Illustr.* On dead leaves, &c., Kenilworth Castle, *Cooke, Illustr.*, 1136.

(To be continued.)

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—December 4th. MICROSCOPICAL SECTION.—A lecture was delivered in the Biological Theatre, Mason College, to a crowded audience of the above society and its friends, by A. W. Wills, Esq., J.P., on “Burmah and its People.” The lecture was illustrated by about a hundred lantern views, selected from photographs which he had taken during his recent tour. These were thrown on to the screen by Mr. C. Pumphrey, with the aid of a new apparatus giving a brilliant white light superior to the lime-light. Mr. Wills, in introducing his subject, referred to the outward trip, briefly describing Aden, Ceylon, and India, which continent he traversed as far as Darjeeling; then he proceeded to describe his entrance into Burmah by the River Irawady to Rangoon. Here he showed views of its temples, homes of the Buddhist priests, and luxuriant foliage. He then described Toongho, on the River Sitang, and showed views of its bungalows, street scenes, and a number of natives in their picturesque costumes, which, he said, were often gorgeous in colour, but always in good taste. The district *en route* to Mandalay revealed much tropical scenery—the jungle, the paddy fields, and an area of fifty miles where the cactus, from six feet to thirty feet high, of many curious forms, are the chief objects in the landscape. He brought his most instructive and interesting lecture to a close by some splendid photographs of Mandalay and its palaces.—December 9th. BIOLOGICAL SECTION.—Mr. W. H. Wilkinson in the chair. Mr. J. B. Williams, of Toronto, read a paper on Canadian birds, which he illustrated by an interesting collection of dried skins, fifty-two in number, of his own collecting, from the neighbourhood of Toronto. He also exhibited eggs of the Canadian stick insect, *Diaphemora femorata*.—December 16th. GEOLOGICAL SECTION.—Mr. C. Pumphrey in the chair. The chairman called the attention of the members to two photographs, kindly presented to the society by Mr. W. R. Hughes. (1) A photograph of the late Miss Constance Naden. (2) A photograph of the members who joined the Marine Excursion to Falmouth, in 1879. Mr. W. R. Hughes exhibited and described the pedunculate form of *Antedon rosaceus* (*Comatula rosacea*), showing the early stages of the development of the plates and the arms of the rosy feather-star-fish before it becomes free. Mr. Madeley, of the Dudley Geological and Scientific Society and Midland Field Club, read a paper on “Crinoids,” illustrated by several fine fossil forms from Dudley and elsewhere. A cordial vote of thanks was given to Mr. Madeley, and he was requested to conduct a party to see the Dudley Crinoids in the excursion season. This he promised gladly to do.

THE SCOPE OF SOCIOLOGY.*

BY MARY E. DALTON.

From considering the evolution of Inorganic and Organic organisms, the Synthetic Philosophy passes to that Super-organic Evolution which deals with "all those processes and products which imply the co-ordinated actions of many individuals"—a study which has, for the general student, a far greater value and more immediately practical aim. Social life, no less than individual, conforms to the general formula of evolution, and passes "from an indefinite, incoherent homogeneity to a definite, coherent heterogeneity." There is, obviously, a natural sequence among social actions; and to find this, that men may avoid evil and secure good as the result of future activity, is the practical aim of the Sociologist. The value of a science of government which should be based upon the application of the immutable laws which govern the universe cannot be over-estimated; and complex and difficult as the study of Sociology necessarily is, it is amply rewarded by proving the possibilities of such a science.

Having as data for our work social units whose nature—physical, emotional, and intellectual—we know, and with whose external conditions of life we are familiar, we proceed to an examination of the nature, origin, and development of all the phenomena resulting from their collective and combined action—all the varied and multiform phenomena presented by present and past social arrangements. We trace our present social unit back to his remote ancestor, and see how natural has been the evolution of the primitive man's system of thought: the one essential to right understanding is gained when we cease to figure the mental processes of the savage in terms of our own, and see him simply as the almost passive recipient of conclusions forced upon him from without. Having verified historical inference by existing proofs, we find the old conception of a time when "free in woods the noble savage ran" absolutely untrue. Helped by the data of our Sociologic science to see "distant things as intimately deep as if we touched them," we see that same savage an almost absolute slave of external circumstance and internal terror. Without reflection or developed knowledge, he could only learn by slow process of repeated trial, and he paid with

*A paper read before a meeting of the Sociological Section of the Birmingham Natural History and Microscopical Society, held June 20th, 1890. Communicated by Mr. W. R. Hughes, F.L.S.

his blood the penalty of mistake and failure. Among the favourite platform platitudes of modern Socialists are the claim for man of "natural rights," and the sentiment that many people have no share in the blessings of our civilisation. Every living person—the poorest, the lowest, the most degraded—shares an inheritance of knowledge, doctrines, and ideas, which long ages have gathered as the fruits of civilisation. The "natural" rights of man are to struggle and to endure; but our own great inheritance of established rights is the harvest of long ages of successful experiments. The living gather the fruit of seed sown by the dead, and feed their hope and faith by a knowledge of how great was the chaos from which their order sprang, and how infinite must be the possibilities still latent in humanity. The great moral gain from the study of Sociology is the perception of by what prodigious struggles, not only our material good, but "gentleness, virtue, wisdom, and endurance" have been gained—the knowledge that always "what *shall be* betters what has been and is;" that the unceasing tendency of the ages is towards the final perfection of all things. We find our only revelation of God, or the Great First Cause, in the thought of man; and the revelation is more divine and beautiful than our old dreams had told us—

"The end of it is love,
The heart of it is peace and consummation sweet."

We pass with evolution from the arid realm of orthodox theology and breathe an "ampler ether, a diviner air."

The conduct of primitive man was in part determined by the feelings with which he regarded the living men around him, and in part by the feelings with which he regarded men who had passed away. Incomprehensible power is the fruitful parent of fear: the fear of the living became the root of the political control; the fear of the dead, the root of the religious control; and these, with kindred secondary developments, have resulted in the tangled web of human society as we now know it.

In considering our data for the study of Sociology we have necessarily included much of Sociology itself, since in no case can the data of a science be stated before some knowledge of the science has been reached. What are the phenomena included within the scope of Sociology?

The development of the family has first to be considered, since this is the primitive society. The association of man and woman, of parent and child, originally for the satisfaction of purely physical wants, has developed into

that mighty system of human intercourse, which now talks of the "brotherhood" of man and the federation of the whole world.

We must trace the history of the marriage relation from its early incoherent indefiniteness to the present stage of its progress towards the more equal and perfect monogamy which future development will bring. We shall see how this relation affects, and is affected by, all other social relations, more especially the closely allied parental and filial relations. In connection, too, with the mutual relations of men and women we shall trace the gradual growth of that principle of sexual equality, which is, as yet, fully developed only among the highest individuals of the highest type of our latest civilisations. The emancipation of one half of humanity from the servitude to which a greater degree of physical weakness condemned it in the savage life; the establishment of woman's right to the full and free development of her whole nature—physical and mental, as well as emotional—suggest problems as to the future which only a knowledge of the past can solve. The tendency of things, visible through all the confusion of modern thought on the subject, seems to be towards the recognition of a perfect equality of worth, based on the essential difference of work and function. To the Sociologist there is no fear that the agitation for securing an improvement in the present condition of women will prove as disastrous as its opponents claim. The untrained enthusiast may look for an immediate revolution of position; the scientist, who knows how slowly great and permanent changes in human life are effected, finds a brighter hope and a higher ideal in the gradual evolution of character.

Indeed, the attainable ideal to which Sociology points is the development of the whole possibilities latent in humanity. The physical, moral, and intellectual may culminate in the unknown powers whose existence is dimly guessed as the result of hypnotic and kindred experiments; but the development of old and new is contemporaneous. It is an assurance of progress that the higher powers of human life, called into existence by improved environment and new wants, bear buds of fair promise even before the lower nature has ripened its fruit to perfection. "The mills of God grind slowly," but they never cease their grinding, and the result is sure.

As a result of the aggregation of allied families we find the tribe, and this we trace until it develops into the state, which presents such varied forms in the different social types—nomadic and settled, military and industrial. Of these

types the latest, which is settled and industrial, is the highest. Within a period of time which, to the scientist, is very small, it has passed through many phases; and the form which it will ultimately take is the most pressing of our modern problems. We have to consider also all the machinery of civil government, and all the work it does, as well as the constantly changing relations between the governing and the governed. We shall trace the slow downward filtration of power from the one to the many; the gradual change from the despotism of the autocrat to the despotism of the democracy; and in relation to this development we shall examine the uses and fright limits of all governing institutions, finding the individualistic and socialistic sharply contrasted in the data from which we draw our conclusions.

Side by side with these political structures and functions, and often almost indistinguishable from them, there sprang up the ecclesiastical and ceremonial institutions, whose gradual differentiation from the civil government, and separate work and character must be studied. The fear of the living caused them to be propitiated by ceremonies and sacrifices greatly resembling those offered to the dead. Those powerful among the living are naturally believed to be powerful also among the dead; it is only as the "long result of time" that king and priest, church and state, became ever more divergent and distinct.

In addition, we have to consider the way in which the ecclesiastical structure gave rise to a code of religious ceremonial, and to a distinct code of morality; and always whatever may be the phenomena with which we are dealing, we shall consider their relation to the mental nature of our social units, and how the action and reaction of the two mutually modify each other. In this later development we shall find not only that the church and state—the religious and the legal—become more and more distinct, but that morality outgrows the ideals of the religion which claims to be inseparably connected with it, and becomes more and more divorced from orthodox faith. In tracing the development of the idea of divinity, from the untutored ignorance which natural appearances impressed with a belief in duality; and which knowledge of oppression and tyranny, suffered from the living representatives of power, filled with awe and terror of the unknown dead, to our most advanced knowledge, we see incidentally how man's physical needs and surroundings have developed conscience and the moral sense.

(To be continued.)

A VISIT TO THE NORTH CAPE AND NORWAY. ILLUSTRATED BY A SERIES OF 150 LANTERN SLIDES.*

BY C. PUMPHREY AND W. P. MARSHALL.

In this visit to Norway, Bergen (the capital), was first stopped at; and we then proceeded northwards by one of the special North Cape tourist steamers, the *Olaf Kyrre*, stopping on the way at many places of interest, staying a night at Trondhjem, the ancient capital of Norway, and finally landing at the North Cape to see the Midnight Sun from the summit of the rock. We then returned southwards, visiting several other places on the way back, and left the steamer at Molde, one day's sail short of Bergen; and from there took an inland trip of three weeks to visit some of the beautiful and grand scenery of the Norwegian "fjords" or creeks, the "dals" or valleys, the "vands" or lakes, the "fos" or waterfalls, and the "braes" or glaciers.

The whole distance from here to the North Cape is about 2,000 miles, and the time away from home was six weeks, of which a fortnight was taken in the trip from Bergen to the North Cape and back. The sea passage of about 400 miles from Newcastle to Bergen took one day and two nights; and in the course of the steamer to the North Cape and back, there were visited on the way, either in going or returning, Molde and Trondhjem, the Torghatten Island Rock, the Svartisen Glacier, the Lofoden Islands, Tromsø, where a Lapp encampment was seen; the beautiful Lyngen Fjord, Hammerfest, the most northern town in the world, being in 70° north latitude; and the Svaerholt Bird-rock.

On the 6th July the North Cape was reached, which is only 19°, or about 1,300 miles distant from the North Pole. At the Svartisen Glacier, the Arctic circle was passed, and whilst we were within the circle the sun remained continuously above the horizon for six days and five nights, and we were so fortunate as to be able to see it at midnight on four of those nights. At the North Cape the sun never sets for as long as two months and a half in the summer, but then on the other hand it is never seen for two months and a half in the winter.

The inland excursion from Molde round to Bergen was first up the celebrated Romsdal Valley, thirty miles in length, and back again, passing between the great Romsdalshorn

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and Trolltindern, that stand one on each side of the valley, towering up to heights of 5,000ft. and 6,000ft. Then to the Geiranger Fjord, and the beautiful Seven Sisters' Waterfalls, and to the Bixdal Glacier; then up the great Sogne Fjord, which extends 110 miles inland from the sea, to Laerdalsoren, Jostedal, and the Nigaards Brae Glacier. Then through Naero Fjord and Naerodal to Eide and the great Voringfos Waterfall, and on to Odde, Bixdal Glacier, and the Gorsvingane Pass at 3,500ft. elevation, returning by the Hardanger Fjord to Bergen.

A remarkable circumstance to be noticed in Norway is the very exceptional mildness of the climate, notwithstanding its extreme northerly position; all the other countries of the world in the same latitude as the northern portion of Norway, are permanently frozen up all the year with snow-covered glaciers; but in Norway, the harbour even of Hammerfest, which is close to the North Cape, is never frozen. This is entirely due to the extraordinary warming power of the Gulf Stream, which emerges from the Gulf of Mexico at a temperature as high as 84° , crosses the Atlantic in a gigantic stream 300 miles wide and near a quarter of a mile in thickness, flowing at a speed of about two miles an hour, and then strikes upon the coast of Norway, flowing all along the coast past the North Cape, where it discharges itself into the Arctic Ocean; having given off in its course 52° of heat, the difference between 32° in the Arctic Ocean and 84° on leaving the Gulf of Mexico.

DESCRIPTION OF THE SLIDES.

- 1.—Norge steamer on landing at Bergen from Newcastle.
- 2.—Bergen fish market; the fish is sold direct from the boats, which are drawn up alongside the quay.
- 3.—Another view of Bergen fish market, showing the crowd of people on the quay bargaining with the fishermen.
- 4.—Bergen harbour warehouses, wooden buildings carried out into the harbour upon piles, so that the boats can get alongside of the warehouses.
- 5.—The quay, Bergen harbour, showing the row of curious hand cranes, "Vippebom," consisting of a light spar slung upon a mast, the short end of the spar projecting over the boat and carrying a sling, and the long outer end having a rope by which it is hauled down by hand, lifting up the goods out of the boat.
- 6.—Bergen market boats; at one part of the market is a special quay, with a number of boats lying alongside close together, which have come in from various farms along the coast of the fjord, laden with market produce, vegetables, fruit, poultry, and eggs, and also some with crockery and wood furniture, &c.; the boats are covered with temporary wood roofs, and converted into regular shops or market stalls, and the customers step on and off from the quay; a very singular sight.
- 7.—Trimming cod in Bergen fish market. The sun-dried fish are landed upon the wharf from boats and stacked in sheds, where

they are "trimmed" by chopping off the heads and tails, and then packed in barrels for export. They are literally as dry as sticks, and the process of trimming is just like chopping wood; the refuse heads and tails go for manure. There is a large trade in this dried fish for winter food throughout the country, and also to Italy. It looked as if it would need a great deal of stewing.

- 8.—Hand-dredging in Bergen harbour; a very primitive apparatus, a scoop and bag at the end of a long pole that is attached about the middle to the side of the dredging boat, and is let down vertically to the bottom of the water, guided by a man who has hold of the pole. A chain attached to the scoop is then hauled up by a windlass worked by a man who climbs up the edge of a large wheel that is fitted with projecting pegs on each side to form steps, like a treadmill wheel in action.
- 9.—Shows the dredger when the scoop is dragged up to the surface, bringing up a bag full of stones and mud, which is emptied out into a barge alongside by the man who has hold of the pole. There are two dredging scoops and wheels, one on each side of the boat. It was a comical sight to watch the men climbing up the wheels, one of which was worked by two men, one of them climbing up on each face of the wheel.
- 10.—The Bergen telephone office, a fine building, with a lofty framework on the roof, carrying a wilderness of wires. The telephone and telegraph are in very extensive use in Norway, and the telegraph is carried into out-of-the-way regions, where it is of great service to the tourist, enabling him to engage in advance "hestes," horses; or "middag," dinner; or "senge," beds.
- 11.—The "Torvet," the main quay, and the "Floien" hill, Bergen, which are beautifully situated in a recess in a large irregular bay, surrounded by hills giving charming picturesque views; at the back of the town is a hill, 800ft. high, with the "Floien" on the summit, a large iron vane; and an extensive public promenade is carried in zigzags up the hill called the "Drammens vei," or dram road, about which is a curious history. The sale of spirits is strictly limited to a company, under the control of the magistrates; and the profits, beyond a fixed dividend, are applied to public improvements, and the cost of this public road up the hill has been defrayed from this source, so that it goes by the name of the "Dram Road."
- 12.—The Nordnaes Garde, a specimen of the streets of Bergen, with their wooden houses.
- 13.—The "Stave Kirke," or wooden church, near Bergen, an interesting example of the curious ancient wooden churches of the country, now out of use. This one was brought from a distant secluded spot by the American Consul, who bought it, and set it up in a picturesque situation in his own grounds, a few miles from Bergen, where it is a favourite sight for visitors.
- 14.—The North Cape steamer, Olaf Kyrre, arrived at Trondhjem, the ancient capital of Norway.
- 15.—The quay at Trondhjem, with boats lying in front of the warehouses.
- 16.—Trondhjem Cathedral, an ancient church of much interest, which is now being restored; the nave has been without a roof for nearly 300 years, service being carried on in the other portion of the church.
- 16A.—East end of the cathedral.
- 17.—The north-west angle of the cathedral exterior.

- 18.—The interior of the cathedral, east end, showing the restoration of the very elegant and unique slender shafts with arched ribs; these are built in grey stone and white marble.
- 19.—Thorwaldsen's celebrated colossal figure of Christ. This is a cast from the original marble figure at Copenhagen, and was presented by the sculptor to the Trondhjem Cathedral.
- 20.—The Bridge over the Nid at Trondhjem.
- 21.—A curious old stone carving over the office of the Mineral Water Co.; subject, "Moses striking the Rock," Moses being represented in the costume of the mineral water craft, and the children of Israel hurrying up to drink from the spring of mineral water.
- 22.—An admiring crowd watching the process of making a sketch of Moses and Co.
- 23.—Lerfos, a waterfall in the river, near Trondhjem.
- 24.—First view of the great island rock, Torghatten, a remarkable rock standing up alone in the open sea, about 800ft. in height, and called, from a fancied resemblance to a floating hat, Torghætta, or market hat. It has a singular natural archway pierced through it, at about two-thirds of the height, which is a special object for tourists to visit. The legend is that the hole was made by the Old Gentleman shooting an arrow through the hat.
- 25.—Is a view, taken during the ascent to the archway, which presented fine views, and quantities of flowers were found on the way.
- 26.—The entrance to the archway, which is there 60ft. in height; the archway is 240ft. in length through the rock, and slopes down steeply to the other end, which is more than 200ft. in height.
- 27.—The view from the other end, which is very striking and beautiful, looking over an expanse of sea, studded with a number of small islands.
- 28.—A group of tourists on the steamer, after leaving Torghatten.
- 29.—One of the Lofoden Islands, "Ost Vaago;" these are an extensive group of islands, standing out to sea at a distance of two hours' steaming from the mainland, and resembling the Hebrides in position, but with very remarkable bold, jagged, mountain outlines. In calm weather, as was fortunately the case when we were there, the tourist steamer goes out between two of the islands into the open sea beyond, returning through another narrow rocky passage, the "Raftsund," which is specially fine in scenery.
- 30.—Another view in going round the island of Ost Vaago.
- 31.—View in passing through the Raftsund.
- 32.—Photograph from a sketch taken of the most remarkable mountain outline in the Raftsund, called the "Shark's Teeth," from its very jagged outline. Some farm houses are seen near the shore, and there is an extensive fishing carried on in these islands in the early part of the year.
- 33.—Photograph from a sketch, taken from the steamer, of the remarkable outline of the Lofodens. The upper figure shows the striking outline of one isolated mountain rock, that stands up nearly vertical on one face.
- 34.—The town of Tromsøe, where we all landed, to go a couple of miles up Tromsøedal, for the purpose of seeing a Lapp encampment, with a herd of 200 reindeer.

- 35.—A Lapp hut, "Gamme," in Tromsoedal, a wretched little hovel, out of which we saw no less than twenty men, women, and children emerge, to stare at the visitors and traffic in rude bone carvings and in skins and furs.
- 36.—A Lapp skin warehouse.
- 37.—Some of the reindeer. The herd was confined within a rough fence, and the young ones were being caught, and marked by cutting a notch in the ear; the whole herd was then let out, trotting off in fine style up the hill side, and presenting a very pretty sight in crossing several patches of snow.
- 38.—A group of Lapps, taken by Dr. Tempest Anderson; they are a diminutive, uninteresting race, more remarkable for dirt than for anything else.
- 39.—Our first sight of the Midnight Sun; a photograph from a sketch taken at the time. The steamer went specially out of its course to take up a position at midnight where there was a clear view to the north between the islands.
- 39A.—Photograph from a map showing the spot (marked by a x) from which this view of the Midnight Sun was obtained. This map illustrates the remarkable multitude of islands that fringe the coast of Norway.
- 40.—Hammerfest, the most northern town in the world, being 70° north latitude, and within half a day's sail of the North Cape. The situation of this town is very remarkable. From the extraordinary warming power of the Gulf Stream, the harbour is never frozen, although those in other countries considerably further south are continuously frozen up for many months of the winter. The weather was very warm when we were there in July, and the temperature was as high as 70° in the shade.
- 41.—Hammerfest harbour. A great manufacture of cod liver oil is carried on here, and there is a long line of factories on the other side of the harbour.
- 42.—Group on board the steamer after leaving Hammerfest, showing one of the party dressed up in a full Lapp costume of furs, including cap and boots, in which he had invested for taking home.
- 43.—Svaerholt, the great bird rock, opposite the North Cape—a great precipitous rock, 1,200 feet in height, rising straight out of the sea, that is the breeding ground of an enormous colony of sea birds. On approaching the rock, the birds are seen perched in innumerable rows upon long lines of ledges, extending over the whole face of the rock; and then, when startled by the firing of a cannon from the steamer, the whole colony is seen in a few seconds flying overhead in so dense a swarm as to cover the sky with white like a snow storm.
- 44.—View of the North Cape rocks from the steamer. The North Cape is on an island, with the rocks at the northern extremity rising abruptly from the sea to a height of 900 feet.
- 45.—Rocks at the landing place, which is on the eastern side of the island, where a steep zigzag path is carried up a ravine from the shore, and a further walk of a mile at the top brings us to the North Cape itself.
- 46.—The midnight sun and clouds from the North Cape. The sun afterwards came out clear of the clouds and shone brightly, casting sharp shadows, and giving as much light at midnight as an average autumn afternoon here. The temperature was quite mild—54° at midnight—and the air soft and pleasant; and it

was very difficult to realise that we were actually standing within 1,300 miles distance of the North Pole itself. We collected a number of plants in flower on the North Cape.

- 47.—A ravine on the west side of the North Cape, where the coast is very bold and picturesque in character. This photograph was also taken at midnight; and it was found by measurement by an actinometer scale that the actinic power of the sun's rays was as great as one-fifth of its actinic power at midday in this country, so that the plate only required exposing five times as long to obtain the picture at midnight.
- 48.—Lyngen Fjord. On the way back from the North Cape the steamer took a two hours' trip up Lyngen Fjord for the purpose of seeing the bold and striking scenery. The mountains along the fjord are very bold in character, rising straight up from the water; with numerous glaciers in the ravines, some of them reaching the sea.
- 49.—Lyngen Fjord. Another ravine, with snow and glaciers.
- 50.—Lyngen Fjord. A further view of rocky peaks, with snow.
- 51.—Lyngen Fjord. A vertical rock face.
- 52.—Molde, where we left the steamer, one day's sail short of Bergen, and started on a three weeks' tour inland. Molde is a very pleasant place to stay at, charmingly situated in a sheltered bay, and looking out over a number of pretty wooded islands in the fjord towards the fine mountain scenery of the Romsdal. This view is taken from the front of the hotel, the seats and tables in the foreground belonging to the hotel.
- 53.—Molde. Main street, with the church in the distance.
- 54.—Furrier's shop, ornamented with reindeer heads.
- 55.—Molde church, with a view of the fjord beyond. The church, like the Norwegian churches generally, is built entirely of wood—even the tower and spire are all wood—and the roof is covered with wood shingles for slates. The whole body of the church, with the tower and spire, is painted with a variety of delicate shades of light brown, drab, and grey, with great taste, and presents a very pleasing effect. This applies also, generally, to the Norwegian churches and larger buildings, excepting in country places, where they are simply painted white; or, in the smallest places, left plain wood, but very neat and clean.
- 56.—Molde pier and warehouses.
- 57.—We then left Molde in a small coasting steamer for the Romsdal, going up Romsdal Fjord, landing at Naes, from which the first view of the great "Romsdalshorn," 5,000ft. in height, was obtained. We then started off to drive up the Romsdal, thirty miles in length, staying two nights at different places in this fine valley, which is one of the special sights of Norway.
- 58.—View of Romsdalshorn, on approaching from Naes, showing the "horn," or peak, that makes it so marked an object. The road passes between the Romsdalshorn on the left, and the still higher "Trolltindern," or Goblin Peaks, nearly 6,000ft. in height, on the right.
- 59.—View of the Romsdalshorn, looking back down the valley, and showing the river in the foreground.
- 60.—The Trolltindern, with its three peaks, seen looking down the valley, with the foot of the Romsdalshorn on the right.
- 61.—Another view of part of the Trolltindern, showing in the foreground one of the large boulders that are strewn in the valley.

62.—Romsdal from Fladmark, where we stopped the first night, with our conveyance standing in the road; a kind of low gig called "Stolkjaerre," of very primitive construction, but decidedly convenient, with space for the driver behind, either sitting upon the luggage or more generally standing up. The harness was of a very simple and primitive make, the reins being only rope, but the pony was excellent, and very satisfactory both in work and looks; a sort of dark cream colour, with a black line all down his back and running through the centre line of the mane, which is thought much of as a sign of good blood; and the mane is carefully trimmed away on each side, leaving a narrow, black crest or ruff standing up some inches high all along the neck. The collar is made to stand high up, clear of the mane, so as not to damage this precious ruff, and the pony looked quite a little dandy, with even his back hair, that is his tail, parted down the middle. We saw many such ponies afterwards, and they are evidently taken much care of by their owners, who are often the drivers, either the owner or a son or daughter. The tourists frequently drive themselves, but we preferred to be independent, for jumping down whenever desired to photograph, or sketch, or to collect plants.

(To be continued.)

THE BIRDS OF OXFORDSHIRE.

(Concluded from page 8.)

Oxfordshire is the only county that can boast of the occurrence of the Alpine Chough, an excellent plate of which is given as a frontispiece. An example was shot in Broughton Park in April, 1881. Although thus straying far beyond its known range, there is yet nothing improbable in the occurrence, as it is recorded twice in Heligoland. A more unusual bird than even this to turn up accidentally in a Midland county is the Andalusian Hemipode, an extremely local species in the countries in which it is found, and certainly a most unlikely wanderer to our shores.

The Raven has been shot as lately as 1888, but has long ceased to be a resident. The Carrion Crow seems fairly common in the north of the county.

That handsome species, the Hoopoe, has several times been noted; and undoubtedly, if unmolested, would remain to nest. This is indeed the case in a neighbouring county, in a locality where a pair of these birds, which come annually, are well cared for and protected.

Mr. Aplin's remarks on the habit of the Green Woodpecker obtaining its food on the ground *throughout the year*, especially amongst ant hills, is a fact which appears to have escaped the notice of ornithologists. Both the Greater and Lesser Spotted Woodpeckers nest in the county.

The variety of the common Partridge in which the chestnut of the "horse-shoe" mark on the breast is replaced by white, has not escaped the author's notice; he has,

however, only once seen an example; this is singular, considering it is not uncommon in parts of England, and indeed in some localities on the increase.

A few pairs of Stone Curlew continue to haunt one locality, although, with the present rage for egg collecting, it is not unlikely they will shortly have to be numbered with other extinct species once belonging to the county.

Considering that Oxfordshire is so far removed from the nearest coast, it is interesting to find so many species of shore birds in the faunal list, including the Grey Plover, Turnstone, Knot, Sanderling, Little Stint, 'Temmincks' Stint, Curlew Sandpiper, Purple Sandpiper, Spotted Redshank, Greenshank, Bar-tailed Godwit, and Whimbrel, all representing species which rarely stray inland during the periods of migration, but are found in greater or less abundance on the sea coast.

The Black, Sandwich, Roseate, Common, Arctic, and Lesser Terns, also the Sooty Tern, are all included in Mr. Aplin's list. Of these the first is an occasional spring and autumn visitor, and there is reliable evidence to show that it at one time remained to nest. A nest with four eggs of the Arctic Tern is said to have been taken on Otmoor in the summer of 1834—as far as England is concerned. perhaps the only instance of the species breeding in an inland situation. The number of the eggs—four—suggests an error in determining the species, as the Arctic Tern has sometimes three, but usually only two eggs in number.

One of the only two authenticated instances of the Sooty Tern obtained in England was an example shot when flying over the Thames, near Wallingford, on the borders of the county.

The Kittiwake, an almost purely marine gull, is an occasional and not an uncommon visitor from autumn to spring. Mr. Aplin has shot it as late as March 24th. A young Iceland Gull, in the first year's plumage, was obtained in the spring of 1836 on Port Meadow. Storm-driven wanderers like the Skuas, Fulmar, Manx Shearwater, Leach's and the Stormy Petrel, with the Guillemot, Razor-bill, Puffin, and Little Auk have been obtained, and the Cormorant, Shag, and Gannet are likewise all accidental in their occurrence.

Two pair of the Great Crested Grebe nest annually on Clattercote Reservoir, and the Red-necked, Slavonian, and Eared Grebes have been occasionally seen. The Little Grebe or Dabchick, is a resident, breeding in some numbers in all likely localities.

The Heron also is a resident nesting in a few spots. The oldest established heronry is that in Tar Wood, near Stanton Harcourt, but the number of nests in late years appears to

have been much reduced. The water meadows in the larger valleys, the low-lying tract of Otmoor, and sheets of water like Clattercote Reservoir, and the great lake at Blenheim, as well as many other artificial waters in the numerous parks of Oxfordshire, are annually attractive to large numbers of wild fowl. For an inland county, the list of the *Annatidæ* is indeed a goodly one, and in comparison with the latest British list it is much the readiest to name the omissions. These are the so-called Polish Swan, at the best a doubtful species; three Arctic geese, namely the Snow Goose, Red-breasted Bernicle, and the Lesser White-fronted Goose; also the Red-crested Pochard, Harlequin, and King Eider, along with five American ducks. This leaves three swans, eight geese, and eighteen species of ducks as either resident, occasional, or rare and accidental visitors to Oxford waters.

No doubt the ornithological richness of Oxfordshire is in a great measure connected with the fact that along much of its south and western boundaries runs the chief river of England—a stream rich in historic lore above all others—in the long days of summer a highway of water, with an ever-shifting panorama of graceful boats and gaily-dressed pleasure seekers, but in the autumn and winter sufficiently quiet and retired to attract numerous passing migrants and inland wanderers whose natural haunts are on the sea coast. River valleys like the Thames are also peculiarly attractive to summer migrants. The long and deep stretches of reeds and bulrushes skirting the banks, the almost impassable willow-holts, and eyots buried in low shrubs and “thorough-grown” with rank masses of water-loving plants, afford conditions most favourable to various aquatic warblers. So also the beautiful hanging woods, in a wealth of tinted foliage which almost seems to rival the brighter glories of autumn, are specially attractive to songsters like the Nightingale, Blackcap, and Garden Warbler. Nowhere, perhaps, on our chief English streams will the ornithologist find more charming pastoral and river scenery than along the upper waters of the Thames and Isis—not unmindful in his wanderings, as he marks the bright moving waters slipping and sliding away towards the sea, that it is the same ancient stream, little altered in itself from the dawn of history, on whose banks, through leagues of forest land, skin-clad hunters pursued the auroch, red deer, and wolf; and centuries later Roman legions, intent on fame and conquest, marked out their camping ground, and kindled watch fires on its southern strand.

In bringing these remarks on Mr. Aplin's pleasant pages to an end, we think ornithologists and others interested in

bird life will thank him for his excellent book—one which, for careful and conscientious preparation, must take a foremost place amongst the number of works of the same class which have appeared during the last thirty years. There is, unfortunately, one feature in common to all these county and local lists—they are too much a record of loss and extermination. Let us hope that at no distant future greater regard will be shown in the preservation and encouragement of the many interesting and beautiful forms of life still left in our country, so that our native fauna may be preserved for the benefit and instruction of those who are to come after us.

JOHN CORDEAUX.

HISTORY OF THE COUNTY BOTANY OF WORCESTER.

BY WM. MATHEWS, M.A.

(Continued from page 19.)

- * *Hypericum Androsæmum*, perforatum, dubium, tetrapterum, humifusum, hirsutum, pulchrum. Tab. 7. In all the districts.
- *† *H. calycinum*, xxix. Malvern D.; shrubbery at Little Malvern for some years. Tab. 7. *Not native*.
- * *H. montanum*. 6, 12, Severn D.; 67, 68, 88, Malvern D. Tab. 7. Avon, Severn, Malvern. *Nash's records from the Avon district, "Mid. Nat.," Vol. X., p. 122, and Perry's from various localities, "Mid. Nat.," Vol. X., p. 258, are omitted from notice.*
- * *H. elodes*, xxxii., lxxxviii. 119, Moseley. 135, Lickey; 139, Tab. 7, Lickey. *Extinct*.
- * *Malva moschata*, sylvestris, rotundifolia. Tab. 7. In all the districts.
- * *Tilia europæa*, xxxix. 4, 6, Severn D. 70, Malvern D. Tab. 7.
- * *T. parvifolia*, xxi. 4, 16, Severn D. 70, 81, Malvern D. Tab. 7.
- * *T. grandiflora*, xxi., xxix., xxxix. 4, Severn D. Tab. 7. Severn, Malvern.
- No Lime recorded in the Avon D.*
- * *Linum usitatissimum*. Tab. 8. In all the districts.
- * *L. catharticum*. Tab. 8. In all the districts.
- * *Radiola millegrana*, 11, 12, Hartlebury Common, 60; 119, Moseley. Tab. 8. Avon, Severn, Lickey.
- * *Geranium phæum*. 3, Redstone Rock, Severn D. Tab. 7. Severn, Malvern, Lickey.
- * *G. striatum*. 40, Severn D. Severn Esplanade, Worcester. *Not native*. Tab. 7.
- G. nodosum*, xxix. Same locality as last. *Not native*. *Query, whether same species intended? Mr. Towndrow writes:—"Mr. T. R. A. Briggs sent me a specimen of G. nodosum, bearing a label as follows: 'Abundantly naturalised near Malvern, Worcestershire. July, 1877. Coll. J. Cosmo Melville.' I have myself never met with either plant.'*

- * *G. sylvaticum*. 3, 6, 59, Wyre Forest, Severn D. Tab. 8. Severn, Lickey.
- * *G. pratense*. 29, Severn D.
- *† *G. sanguineum*. 6, 7, 59, Wyre Forest, *Salop side only*. Tab. 8. Severn.
- * *G. pyrenaicum*, viii. 6, 40, Severn D. Tab. 8. Avon, Severn.
- * *G. pusillum*, *dissectum*, *molle*, *Robertianum*. In all the districts.
- * *G. columbinum*. 100, only noted at Bredon Hill. Tab. 8. In all the districts.
- * *G. rotundifolium*. 95, 137, Avon D. But in Tab. 8 mentioned as growing in one locality in the Severn, Malvern, and Lickey districts.
- * *G. lucidum*. 6, 40, Severn D. 65, Malvern; 124, 134, Lickey D. Tab. 8. All districts except Avon.
- * *Erodium cicutarium*. Tab. 8. In all the districts.
- * *E. moschatum*. Tab. 8. Avon, Malvern, Lickey, with sign of suspicion. *I believe an error in every case.*
- * *E. maritimum*. 9, Habberley Valley; 11, Hartlebury Common, 12, 34, 37; 68, near Barnards Green, Malvern. Tab. 8. Severn, Malvern, Lickey. *The latter is probably Irvine's locality, and requires confirmation.*
- * *Oxalis Acetosella*. Tab. 8. In all the districts.
- * *Ilex Aquifolium*. 4, Severn D.; 69, Malvern D.; 113, Lickey. Tab. 19. In all the districts.
- * *Euonymus europæus*. 40, Severn D. Tab. 8. In all the districts. Not localised in any but the Severn D.
- * *Rhamnus catharticus*. 40, Severn D.; Avon D., 98, Alderminster; 104, Broadway; 124, Avon D., Stour, above Halesowen. Tab. 8. In all the districts.
- * *R. Frangula*. 40, Severn D.; 114, 123, Lickey D. Tab. 8. Severn, Lickey.
- Ulex europæus*. Tab. 8. In all the districts.
- * *U. Gallii*. Tab. 8. In all the districts.
- *† *U. nanus*, xlv., 66. Tab. 8. Severn; Malvern; Lickey. *Very doubtful records. I believe all to be U. Gallii.*
- *† *Genista pilosa*, 73. "Mr. Borrer is recorded, in Hooker and Arnott's British Flora, to have gathered *Genista pilosa* at Little Malvern. I suspect some mistake." See also 144; Tab. 8. An error?
- * *G. tinctoria*. Tab. 8. In all the districts.
- * *G. anglica*. 17, Severn D., footnote. Broadheath, near Worcester. 140, Moseley Green, near Monkswood. Tab. 8. Severn, Malvern, Lickey.
- * *Sarothamnus Scoparius*. Tab. 8. In all the districts.
- * *Ononis arvensis*. Tab. 8. In all the districts.
- * *O. spinosa*. Tab. 8. In all the districts.
- * *Medicago sativa*. Not native. Tab. 8. Avon, Severn, Malvern.
- * *M. maculata*, xvi. 40, Severn D. Banks of the Salwarp, near Porter's Mill; Mr. Smith's hopyard at Wick, near the Severn. Tab. 8. Severn, Malvern.

- M. denticulata.* Additions, Moseley, near Birmingham, 1866. Tab. 8. Lickey.
- * *Anthyllis vulneraria.* 67, 89, Malvern D.; 93, 100, 103, Avon D. But, Tab. 8, in all the districts.
- * *Mellilotus officinalis.* Tab. 8. In all the districts.
- M. arvensis.* 12, Severn D. Gathered by the writer at Wolverley in 1853. Tab. 8.
- * *Trifolium pratense, medium, repens, procumbens, filiforme.* Tab. 9. In all the districts.
- * *T. ochroleucum.* 89, Broadwas. Tab. 9. Severn.
- T. incarnatum.* Tab. 9. Occasional in the Severn district. *Not native. First record.*
- * *T. arvense.* 12, 59, Severn D. Tab. 9. All districts but Lickey. *It probably occurs in that.*
- * *T. striatum.* 12, Severn D. Tab. 9. Avon, Severn, Malvern.
- * *T. fragiferum.* 41, Severn D.; 93, Avon D.; Cracombe. Tab. 9. In all the districts.
- * *Lotus corniculatus, major.* Tab. 9. In all the districts.
- * *L. tenuis.* 92, 93, Avon D. But in Tab. 9. In all the districts.
- * *Astragalus hypoglottis.* 99, 100, 137, Avon D. Broadway Hill; Bredon Hill. Tab. 9. Avon.
- * *A. glycyphyllus.* 6, 41, Severn D.; 67, Malvern D.; 93, Avon D. Tab. 10. All districts except Lickey.
- * *Ornithopus perpusillus.* 12, 60, Severn D.; 66, Malvern D.; 119, Lickey. Tab. 10. All districts except Avon.
- * *Hippocrepis comosa.* 99, Bredon; 105, Hyate's Pits (*Gloucester*). *The writer has gathered it abundantly at Broadway.* Tab. 10. Avon.
- * *Onobrychis sativa.* 41, Severn D.; 67, 89, Malvern D.; 100, 103, Avon D. Tab. 10. All districts but Lickey.
- * *Vicia hirsuta, tetrasperma.* Tab. 9. In all the districts.
- V. gracilis.* 41, near Worcester. Tab. 10. Severn, Malvern. *First record.*
- * *V. sylvatica.* 6, 18, Severn D.; 67, 86, Malvern D.; 100, 106, Avon D. Tab. 9. All districts except Lickey.
- * *V. Cracca, sepium, sativa.* Tab. 9. In all the districts.
- * *V. Bithynica, ix.* 41, Severn D.; Cruckbarrow Hill; 67, Malvern D. Tab. 9. Severn, Malvern.
- * *V. lathyroides, viii.* 60, Hartlebury Common; 93, Avon.
- * *Lathyrus Aphaca.* 41, Norton Field; 89, Powick; 94, Avon D. Tab. 9. All districts except Lickey.
- * *L. Nissolia.* 41, Severn D.; 93, 100, Avon D. Tab. 9. Avon, Severn, Malvern.
- * *L. pratensis.* Tab. 9. All the districts.
- * *L. sylvestris.* 41, Severn D.; 68, Malvern D.; 93, Avon D. Tab. 9. All districts except Lickey.

- * *L. palustris*. 35, 61, 135, Longdon Marsh. Tab. 9. Malvern D.
- * *Orob. tuberosus*. 72. Tab. 10. All the districts.
- * *Var. tenuifolius*. 5, Wyre Forest; 68, Little Malvern. Tab. 10. Severn, Malvern.
- † *Coronilla varia*, xxix. Severn side, above Bewdley, Salop. *Not native*.
- * *Prunus spinosa*. Tab. 10. In all the districts. *First noticed in "Bot. Malvern Hills," 1st Edit. p. 23. Accidentally omitted from notice of that work in "Mid. Nat.," Vol. XII., p. 142.*
- *† *P. insititia*. 6, Wyre Forest. Tab. 10. Very rare in all the districts. *Probably P. spinosa var. fruticans, in some cases, mistaken for it.*
- * *P. domestica*. 5, Wyre Forest. Tab. 10. In all the districts (?) *Not native*.
- * *P. Avium*, xvi. 6, Wyre Forest; 28, 41, woods opposite Holt Castle, and at Ombersley; 70, Malvern D.; 128, Wychbury Wood. Tab. 10. In all the districts.
- * *P. Cerasus*. 6, near Bewdley. Tab. 10. Severn, Malvern.
- † *Spiræa salicifolia*, xxix. 6, 8, Dowles Brook, above Bewdley. Tab. 10. Severn (*Salop*). Malvern. Extinct in latter district. *Not native*.
- S. Ulmaria*. Tab. 10. In all the districts.
- * *S. Filipendula*. 92, 98, 100, Avon D. Tab. 10. Avon, Severn, Malvern.
- * *Sanguisorba officinalis*. Tab. 10. In all the districts.
- * *Poterium Sanguisorba*. 93, 100, 104. Tab. 10. In all the districts. (*Lickey doubtful.*)
- * *P. muricatum*, lvi. 74, The Wych; 93, field near Trench Wood. Tab. 10. Avon, Malvern.
- * *Agrimonia Eupatoria*. Tab. 10. In all the districts.
- A. odorata*, lvi. (*Northern limit given as York, but grows as far north as the Isle of Arran.*) 93, 94, Tildesley Wood, Pershore; 123, Hunnington, near Halesowen. Tab. 10. In all the districts, *but not given in text for Severn and Malvern. First record.*
- * *Alchemilla vulgaris*, arvensis. Tab. 10. In all the districts.
- * *Potentilla Fragariastrum*, *Tormentilla*, *reptans*, *anserina*. In all the districts.
- * *P. argentea*. 12, 41, Severn D. Tab. 10. Severn, Malvern.
- * *P. verna*. 65, 72, Malvern Hills. Tab. 10. Malvern. Also in Add. and Cor.
- * *P. procumbens*. xlv. 135. Tab. 10. Malvern, Lickey.
- * *Comarum palustre*, x. 12, Hartlebury Common; 60, pools between Hagley and Kidderminster; 120, Moseley. Tab. 10. Severn, Lickey.
- * *Fragaria vesca*. 72. Tab. 10. In all the districts.
- F. elatior*, lxi. 96. Tab. 10. Avon. *New record.*

(To be continued.)

Reviews.

Catalogue of Canadian Plants. Part V., Acrogens. By JOHN MACOUN, M.A., F.L.S., F.R.S.C. Montreal: William Foster Brown and Co. 1890. 25 cents. Pp. iv.—179.

THIS concludes Vol. II. of this valuable work, the first 45 pages being devoted to an enumeration of the Ferns and Fern Allies, with a full account of their geographical distribution through the Dominion of Canada; and, as in the preceding portions of this work, the treatment throughout is excellent, and characteristic of the scientific acumen and indefatigable zeal of the author. In turning over the pages of the Catalogue the first thing that strikes one is the strong relationship that exists between the flora of Canada and that of Europe. This is more apparent in the higher Cryptogams than in the Flowering plants. The same Ferns, Horse-tails, and Club Mosses make their home there as with us. In the Equisetaceæ, or Horse-tails, 13 species and 2 varieties are recorded, 10 of which are native also of Europe. Many of these are widely spread over the Dominion, but the Great Horse-tail, *E. Telmateia*, seems to be found only on the Pacific slopes.

Of Ferns, 60 species and 10 varieties are recorded, many of which are also European. The Adder's-tongue, *Ophioglossum vulgatum*, occurs in grassy meadows, and is widely spread. The Moonwort, *Botrychium Lunaria*, ranges from Quebec to British Columbia, and high northward, with other European species, as *B. simplex*, *B. lanceolatum*, and *B. virginianum*, the latter having a wide range north-east and northward almost to the Arctic Circle. The common Polypody, *Polypodium vulgare*, is found from the Atlantic to the Pacific, and far north. The Brake Fern, *Pteris aquilina*, has a range equally wide; whilst the Hard Fern, *Lomaria spicant*, is confined to the coast of British Columbia, being abundant there in rich, cool woods. Of the Spleenworts, *Asplenium viride*, *A. Trichomanes*, and *A. Filix-fœmina* have a wide range; but the Rue Fern, *A. Ruta-muraria*, appears to be absent both from Canada and the United States. The Hart's-tongue, *Scolopendrium vulgare*, is one of the rarest of American ferns, only three stations being known in Canada. The Beech Fern, *Phegopteris polypodioides*, and Oak Fern, *P. Dryopteris*, are both wide in their range; but the Limestone Fern, *P. Robertianum*, and the Alpine Lady Fern, *P. alpestris*, are more rare, the latter ascending to an altitude of 7,000 feet above sea level. Of the Shield Ferns, the Marsh Shield Fern, *Aspidium Thelypteris*, is common in swamps from Nova Scotia to Lake Winnipeg; and they also find more or less abundant over a wide area *A. Oreopteris*, *A. cristatum*, *A. Filix-mas*, *A. rigidum*, *A. spinulosum*, *A. dilatatum*, *A. Lonchitis*, and *A. aculeatum*. The Bladder Ferns are represented by *Cystopteris fragilis*, which is universally distributed throughout Canada; and the beautiful *Cystopteris montana*, which is a rare fern, found in low, dense woods, usually near creeks, being recorded from Labrador, Quebec, Ontario, and the Rocky Mountains. The beautiful genus *Woodsia* has three European representatives,

W. glabella, *W. hyperborea*, and *W. Ilvensis*, all widely spread, and extending to the Arctic circle, often found in great abundance; and the noble Flowering Fern, *Osmunda regalis*, is recorded as of common occurrence in the eastern half of the territory.

Of the Club Moss family, 9 species and 6 varieties are recorded. Of European species, *Lycopodium Selago* is not uncommon on mountains and northwards; *L. inundatum* is found in swamps, mostly eastwards; *L. annotinum*, *L. clavatum*, and *L. complanatum* are spread over a wide extent of the territory; *L. alpinum* is doubtfully recorded from the summit of Gold Range, altitude 6,500 feet; and *Selaginella spinosa* is widely distributed in wet, grassy places by rivers, and on mountains.

Of the Quillworts 7 species are found, the European species, *Isoetes lacustris* and *I. echinospora*, having a limited range, mostly in the eastern portion of the territory.

The remaining portion of Part V. is devoted to Additions and Corrections to Parts I.—IV., which occupy 103 pages, and record 155 species added to the flora of Canada since the publication of Part IV., raising the total number of Flowering Plants, Ferns, and Fern Allies found in Canada to 3,209 species; of these 2,340 are Exogens, 771 are Endogens, and 98 are Acrogens.

Part VI., which will be issued during the present year, will include Characeæ, Musci, and Hepaticæ, upwards of 1,000 species being now recorded. This will be of great interest to all bryologists.

The author and his coadjutors are to be congratulated on the excellent results of their labours. The difficulties with which they have had to contend can scarcely be realised. The vastness of the country they have explored, the inaccessibility of many of the districts, and the difficulties of travel connected with this exploration, are such as to deter any but truly earnest workers; and no praise can be too high for the energy exerted in the investigation, and the ability displayed in determining the various plants found, and in arranging and classifying the materials obtained.

With the above, and also forming part of the Natural History Survey of Canada, is a "List of Canadian Hepaticæ," by Wm. H. Pearson. The author of this is one of our foremost British authorities on the Hepaticæ, and this list is the result of the microscopical examination of a large collection of Hepaticæ made by Prof. Macoun in various parts of Canada. To make this record more complete, Mr. Pearson has added species recorded by Mitten in the "Proceedings of the Linnean Society," and other writers. The result is a record occupying 28 pages of letterpress, giving an account of the distribution of 163 species, several of them new to science, throughout the Dominion of Canada. The new and very rare species are illustrated on twelve beautifully drawn plates, which render the work doubly valuable. This is a very valuable and interesting addition to botanical literature, and will be fully appreciated by all lovers of bryological studies. As Mr. Pearson observes in his preface, "The striking feature of the flora is its great similarity to that of Northern Europe."

J. E. BAGNALL.

Elementary Botany. By JOSEPH W. OLIVER, Lecturer on Botany and Geology at the Midland Institute. Foolscap 8vo, pp. iv.—208. 1891. Two Shillings. London: Blackie and Son (Limited).

A REALLY good elementary treatise on Botany is not only of great value in enabling the young student or beginner to understand and appreciate this beautiful science, but also as serving as a stepping-stone to those more erudite and perfect works of such writers as Sachs, Hofmeister, and others of the great luminaries of botanical science; and should be written not merely as a means to enable students to pass in the Science and Art Examinations, but also with the hope and intention of inspiring them with a true love for a study pure and beautiful. The work under review, although primarily written for the use of students who are studying under the Science and Art Department, is so far above an ordinary cram-book in its style, fulness, and interest as to render it a pleasing and instructive reading book for anyone who desires to gain an intelligent knowledge of botanical science, and may, without exaggeration, be pronounced to be one of the best of our existing elementary treatises on botany. Its language throughout is simple and intelligible, and the scientific terms requisite in such a work are all explained in the text. The illustrations, which are very numerous, are well chosen, ably drawn, and fully explained, some being taken from standard works, but many of them are drawn by the author from the objects themselves; and it may be said with confidence that the student who has mastered the contents of this book, need fear no examination in the elementary or even advanced stage, more especially if he has followed the advice of the author, and added to his reading the knowledge to be gained only by a close personal examination of the objects themselves. The work opens with a preface giving advice as to the most serviceable way in which to use the book; followed by the introduction, in which are defined the terms Botany, Plant, Cryptogam, Phanerogam, &c., and then advice is given to the student as to the appliances required in the study. The general work is divided into five parts, each consisting of two or more chapters.

Part I., "General Morphology," treats of (1) the Plant as a whole; (2) Seeds: Germination, the bean and wheat being taken as examples; (3) the Root; (4) the Stem, a chapter ably written, full of instruction, and thoroughly well illustrated; (5) Leaves: Hairs; and (6) Branching: Branch Systems. This part fills 36 pages of letterpress, and is illustrated by 49 figures.

Part II., "The Anatomy of Plants," commences with an account of (1) the Cell, giving its structure, chemical elements, formation, and contents; (2) the Tissues of Plants, or cells in combination, occupying 33 pages, illustrated by 26 figures.

Part III., "The Physiology of Plants," treats of the life history of plants, and embraces (1) the Food of Plants; (2) Absorption by

Roots: Movement of Water in Plants, Transpiration; (3) Assimilation; (4) Respiration of Plants: Absorption of Gases; (5) Growth of Plants; (6) the Irritability of Growing and other Motile Organs; (7) Influence of Light and Heat on the Various Functions of Plants.

Part IV., "Morphology and Physiology of Flowers," treats of (1) the Inflorescence; (2) the Flower; (3) Fertilization: Fruit and Seed. The whole of this part is clearly written and very fully illustrated with well-drawn and well-chosen figures.

Part V., "Classification and Description of Plants." (1) Classification of Plants; (2) Natural Orders: a very instructive chapter, with very helpful illustrations; (3) Description of Plants. In this, excellent advice is given as to the way in which the student should proceed in describing a plant, followed by five well drawn up descriptions of plants readily obtained.

After this follows the syllabus of the Science and Art Department for Botany, with the various examination papers for the last ten years, 1881 to 1890. The work closes with a very full and useful index, containing nearly 800 references.

I have only to add, in conclusion, that the author may be congratulated upon having produced a book that will be a great help to many a hard worked student, and will, I both hope and anticipate, be the means of instilling a love for botanical science in the hearts of many of the rising generation.

J. E. BAGNALL.

The Darwinian Theory of the Origin of Species. By FRANCIS P. PASCOE, F.L.S.—London: Gurney and Jackson.

THE author of this little book (who is an ex-president of the Entomological Society), while by no means an opponent of the theory of the evolution of organised beings, disbelieves that the principal method of evolution was natural selection as advocated so strongly, and, for the time at least, so successfully, by Charles Darwin. Mr. Pascoe's object is to bring the theory of the origin of species by natural selection "face to face with facts," and "to test how far it is competent to give even a plausible explanation of the endless peculiarities of the organic world." This he seeks to achieve by presenting to the reader the principal instances of biological phenomena and animal structures which cannot readily be explained by the theory. Interspersed throughout the pages of the book are criticisms on natural selection drawn from the writings of various eminent naturalists who were or are opposed to the theory as expounded by Darwin. These criticisms are generally quoted without reference to the context or to the later views of the author; they, therefore, tend to be somewhat misleading.

Mr. Pascoe does not attempt to develop the subject systematically, his various instances of difficulty being cast together in rather a haphazard way; nor does he draw any general conclusions, but leaves the reader to decide for himself on the question. Thus this work does

not materially contribute to a settlement of the problem of the method of evolution, but at the same time it is distinctly useful as collecting into a small space the principal objections which have been raised against the greatest theory yet enunciated to explain the origin of species. The printing is clear, and the index excellent.

A. B. B.

An Introduction to the Study of Petrology: The Igneous Rocks. Introductory Science Text-Books. By F. H. HATCH, Ph.D., F.G.S.
London: Swan, Sonnenschein and Co.

ALTHOUGH there are several works in English which treat fully of the Petrology of Igneous Rocks, yet there is none which is sufficiently elementary, and at the same time full and accurate enough, to supply all the needs of the beginner in the subject. This gap in scientific literature, Dr. Hatch, so well known for his writings on Petrology, has now adequately filled, for he has produced a book which will be in the hands of all students and teachers of the subject, both because there is no work of just the same kind in English, and because of its admirable character.

In the preparation of this book, the author has freely made use of the works of Von Lasaulx, Rosenbusch, Fouqué, Lévy, Lacroix, and Teall; the illustrations are drawn from these and other sources. These names and that of the author are sufficient guarantee of the accuracy of the statements made in this little work, which presumes the reader to possess a certain amount of knowledge of optics and crystallography, but in other respects is elementary in nature, while at the same time it contains the results of the latest and most advanced investigations.

The plan of the book is as follows:—First, we have an account of the occurrence of the igneous rocks; then, their constituent minerals are described. Following these chapters comes one on the structure, chemical composition, and alteration of the igneous rocks, preliminary to a classification and description of the same, which latter subjects take up more than a third of the book. In classifying the igneous rocks, a very difficult task, the author divides them into groups dependent on the proportion of silica present: then each main group is sub-divided into families according to the mode of origin or occurrence, while “mineralogical composition is, on account of its extreme variability, allowed to play only a subsidiary rôle.”

Two very useful features of the book are: first, the notices of the introduction of the respective petrological names, and, secondly, an account of the geographical distribution in the British Isles of the principal rocks described. The illustrations are in many cases very good, and sure to be of use to the student; the printing is clear, and the index full and accurate.

In conclusion, we must congratulate Dr. Hatch on having produced a work which will be welcomed by every student of geology.

A. B. B.

BIOLOGICAL CHARTS.—We have received from the Society for the Promotion of Christian Knowledge two large sheets of pictures in colours (1) of the “Marten” and “Badger,” and (2) of the different stages in the life-history of the “Honey Bee” and “Oakleaf-gall Wasp.” They are intended for use in schools, and are well adapted for teaching purposes. They are two of an excellent series issued by the Society, of which the drawings have all been made under the immediate supervision of Professor Engleder, of Munich. The price is very moderate.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—January 18th. GEOLOGICAL SECTION.—Mr. T. H. Waller, B.A., B.Sc., in the chair. The section congratulated Mr. J. Rabone on his election as an honorary member of the Institute of Journalists. Mr. T. H. Waller, B.A., B.Sc., was unanimously re-elected chairman, and Mr. J. Udall, F.G.S., hon. secretary of the section. Mr. W. R. Hughes, on behalf of Miss Gingell, exhibited specimen of Inferior Oolite, with peculiar markings. Mr. Pumphrey exhibited “a core of an agate.” Mr. Wilkinson exhibited a Peregrine Falcon, shot near Wellington, Salop. Mr. A. Scruton, New Street, Birmingham, was nominated a member of the society. Mr. R. W. Chase described some curious sights he saw early in the month on and near the River Dee. In some parts of the Dee blocks of ice were piled up by the tide, from fifteen to twenty feet high. In other places, locally called “gutters,” the gutters were full of solid ice, tier upon tier, apparently composed of finely laminated pieces like talc or mica. He described the results of the frost as producing the most Arctic sight he ever saw. Mr. Hughes gave a note on “The Giants’ Causeway,” illustrated by specimens and photographs. A cordial vote of thanks was given to Mr. Hughes.

BIRMINGHAM MICROSCOPISTS’ AND NATURALISTS’ UNION.—Nov. 17th. ANNUAL PUBLIC EXHIBITION.—Mr. Cracroft, Vice-president, gave a short address of welcome to the visitors. The following were amongst the more interesting objects:—Mounted ferns and flowering plants, Mr. H. Hawkes; mosses, Mr. J. Collins; fossil leaves from Bournemouth, Mr. P. T. Deakin; fossil shells from Bournemouth, Mr. J. Madison; fossils from Coalbrookdale, Mr. S. White; two cases of micro- and macro-lepidoptera, by Mr. J. W. Moore; a case showing the different orders of insects, by Mr. J. Moore; British and foreign butterflies and moths, Mr. C. P. Neville; land and freshwater shells, by Mr. Hopkins; birds’ eggs, gorgonias, and other objects, by Mr. Linton; peacocks’ tails, by Mr. F. Shrive; the birds of the district, by the Society; marine algæ mounted as lantern slides, by Mr. H. Hawkes; a frame of lantern slides, illustrating the “Wonders of a Pond,” by Mr. J. W. Neville; lantern-scopes and slides, by Mr. W. Tylar; and a series of living and other objects under the microscopes.—Nov. 24th. Mr. J. Collins showed the following rare plants from Cork:—*Juncus acutus*, *Saxifraga umbrosa*, *Euphorbia hiberna*, *Pinguicula grandiflora*, and *P. lusitanica*. Mr. H. Hawkes then read a paper on “Leaves and their Parasites.” The writer said he should not speak of insect parasites; those he should deal with were of fungoid growth, and belonged to one family the Uredineæ. In searching for these fungi, plants must be looked for

of poor, stunted, and deformed appearance. A small space only should be selected for work; a hundred yards of a railway or canal bank carefully worked will yield more specimens than miles of country carelessly looked over. The different plants and their parasites found in a ramble by water-courses and in fields and woods were described. Having gathered the crop, it remains to take the microscope and work out the specimens. Polymorphism, or the appearance of a fungus under several forms, complicated the subject. The writer gave a description of these forms, and the promycelium-spores, æcidiospores, uredospores, and teleutospores. There yet remained much to be done in working out the mysteries of the reproduction of these plants, and there was an abundant harvest for each worker. They do not have the beauty of flowering plants, but are a link in the chain that binds together the attractions of vegetable life. The paper was illustrated by an herbarium, diagrams, and a large series of microscopical preparations.—Dec. 1st. Mr. G. H. Corbett exhibited a large and interesting collection of minerals; Mr. J. Madison, seven specimens of *Helix aspersa*, showing various markings, all bred in confinement from a single pair.—Dec. 8th. Mr. Thompson read a paper on "Charles Darwin." The writer gave a sketch of the ancestry and early days of this distinguished writer, but the greater part of the paper was devoted to the theories of natural selection, development, and the survival of the fittest, subjects that were brought into general prominence by this illustrious man.—Dec. 15th. Mr. Cracroft gave a lecture on "A Ramble through North Wales." The lecture was particularly interesting from the manner in which it was illustrated by photographs of the beautiful scenery. The pictures of erratic boulders and glaciated rocks in the neighbourhood of Llanberis were much admired.—Dec. 22nd. Mr. J. Collins exhibited a series of plants collected during the visit of the Vesey Club to Norway.—January 5th. Mr. J. Collins exhibited a collection of herbarium specimens of the natural orders Primulaceæ, Coniferæ, and Amentaceæ; Mr. G. H. Corbett, a collection of butterflies from India. Under the microscope, Mr. J. W. Neville, sections through floral organs, showing all the parts *in situ*.—January 12th. Mr. J. Betteridge presented to the society's cabinet specimens of Red-backed Shrike, *Lanius colluris*, and Starling, *Sturnus vulgaris*, the latter in transition plumage. Mr. Matley then read a paper on "Heredity." The writer said his object in reading this paper was to introduce the views that had been advanced on this subject, in the hope that further attention might be turned to it. The three factors that established the theory of natural selection, variation, heredity, and the struggle for existence, were carefully expounded. The writer said it was difficult to tell whether a parent transmitted to its offspring the character it inherited or the one acquired in life. All organisms begin life as a single cell, a body was a republic of cells. Germ-cells and body-cells were described, and the theory that, by the process of germ-cells breaking away and becoming body-cells, acquired characters were transmitted. The theory of the intimate connection between the two cells and the gemmules supposed to come from the body-cell to the germ-cell explained much we meet with in heredity, but its difficulty was its complexity. The writer reviewed at some length the continuity theory of Professor Weismann, and explained how, through defective division of the ova, monstrosities were formed, and how the heredity of disease was the result of the inoculation of the germ-cell. In conclusion, the writer said the gist of the whole matter is this, that if the competition of life is less keen, we grow more degenerate, as there is no struggle that keeps alive the nobler attributes of humanity. A discussion closed the meeting.

THE ARAN ISLANDS.*

BY PHILIP B. MASON, F.L.S., F.Z.S., ETC.

WITH ILLUSTRATIONS FROM PHOTOGRAPHS BY MESSRS. J. E. NOWERS
AND J. G. WELLS.

These islands lie off the west coast of Ireland, and are practically in the Atlantic Ocean, although within sight of the coasts of Connemara and Clare. Their nearest point is 28 miles from the quay of Galway, and they lie off the entrance of the fjord which is now called Galway Bay, or Loch Lurgan. Aran is supposed at one time to have been connected on the north with Connemara, on the south-east with Clare, and to have thus formed the boundary of the lake.

They are three in number, and it is supposed derived their name from the Irish word *ara*, "a kidney," which the great island remotely resembles in shape. Their names are Ara Mor, the Great Island; Innis Maan, the Middle Island; and Innis Heer, the Eastern Island (this is usually called the Southern Island). The length of the great island is nine miles, of the middle three, and of the southern one $2\frac{1}{2}$ miles. They contain about 11,288 acres, only 700 of which are productive, and support more than 3,000 people, that is, support them with the help of an occasional relief fund, one of which funds was being administered during my last visit there. I said that only 700 acres are productive, and while approaching the islands one wonders how they can support any living thing, for they present the appearance of undulating stone-fields.

The islands are entirely composed of metamorphosed limestone, and the rainfall is excessive from the fact that they are the first lands struck by the westerly winds which have swept over the Atlantic, and so become saturated with moisture, the result being that the surface of the limestone is dissolved away with such rapidity that no spore of moss or other green thing can find lodgment for a sufficient time to germinate. This barren appearance is intensified by the fact that the numerous divisions between the fields are loose stone walls, like those of North Derbyshire.

On walking over these fields, however, we find that the limestone is extensively fissured, the fissures running more or less in the same direction; and these fissures having been deepened by the solvent action of water to the depth of several

* Extracted from a paper read before the Burton-upon-Trent Archæological and Natural History Society, November 13th, 1890.

feet, contain an abundant flora, of course of lime-loving plants. I have nowhere seen more luxuriant specimens of many ferns, as the *Ceterach*, *Scolopendrium*, *Asplenium Rutamuraria*, *Trichomanes*, *Adiantum nigrum* and *marinum*; and last, but not least, of the true British Maidenhair, *Adiantum Capillus-Veneris*. Of the latter fern I should think that there are more plants growing here than in the remainder of the Three Kingdoms altogether. The wind, however, and the cattle between them cut off these plants to the level of the surface of the rock, so that no green shows at a distance. The only parts that can really be cultivated are the slopes where talus can lodge, and the places which have been covered by the drifting sand. I was quite surprised to see a small circular enclosure which had been built on the flat bare rock, near the beach, at the north point of the great island. In this a thick layer of sand and seaweed had been placed, and is now producing a fine crop of grass. Excellent potatoes are grown in this sand manured by seaweed, as is also the case in the Channel Islands.

A peculiarity of the stone walls is that no gates or openings are left in them, so that when a cow has to be brought from a field at a distance from the road, five or six walls have to be pulled down and rebuilt.

When calcareous rocks are in contact with the sea it is usual to find many caverns excavated by the action of the water, but in Aran there are very few. In many places the lower part of the lofty cliffs has been excavated, leaving ledges on which perch innumerable guillemots, mingled with a few puffins, razorbills, gulls, and choughs, the latter rare bird breeding here. The only place where there is anything in the nature of a cavern is in the south cliff of Ara Mor, where two tunnels have been formed about 150 feet long, the roofs at the inner end of which have fallen in, leaving openings through which water is driven during gales, gaining for them the local name of puffing-holes.

Traces are still left here of one of the glacial epochs, when this part of the world was covered by an ice-sheet, and fine examples are to be found of erratic boulders, or "roches perchés," of granite, brought from the Connemara district, and left by the retreating ice on the limestone. On the opposite shore, on the slopes of Errisbeg, near Roundstone, I have seen the rocks planed by the action of the ice, and grooved by the stones carried beneath it, as the glacier ground them in its slow advance. Of course in Aran itself all such grooves and scratches have long been dissolved away by the effects of the abundant rainfall on a soluble rock. These boulders are called here Connemara stones.

On some parts of the shore are found large accumulations of sand, which are drifted about by the winds, at one time being deposited in fresh places, covering gardens, &c., while at others old accumulations are carried away.

Of course, situated as these islands are in the broad Atlantic, they feel the full force of the winds and waves; and often, when the sea looks as smooth as a millpond, the waters break on the cliffs with such force as to send up showers of spray fully 100 feet in height. In stormy weather the effect is magnificent. I saw great baulks of timber which had been thrown up on cliffs nearly 200 feet high, and here so much seaweed had been thrown up that men were collecting it for the purpose of burning into kelp. There was enough *Laminaria* or Tangle to repay their trouble. A place on the middle island was pointed out to me on which the body of a man had been thrown up on the cliffs quite as high as this, and left many yards inland; and I was shown a place where a few years ago three men had been blown off the cliffs while fishing, and drowned. The most striking example I saw of the power which may be exerted by water driven by the wind was a block of stone, situated about half-tide mark, which, as shown by the grooves in the flat-topped rocks, had been moved between 50 and 100 feet. Here, as elsewhere in limestone formations, the rocks tend to assume the form of flat terraces. I measured this block roughly, and found it to contain about 48 cubic feet of stone. Mr. Nowers, however, measured it more exactly, and calculated that it weighed about 103 tons.

The Land Fauna is a scanty one, as might be expected from its insular position and lack of trees and streams.

There is one very curious fact in connection with the Fauna. The common banded snails *Helix nemoralis* and *hortensis* are of comparatively enormous size and great thickness, being quite double the size of ordinary specimens, while the flat *Helix ericetorum* has the shell much thinner than usual, a very remarkable contrast, considering that they both occur on the calcareous rocks. The Marine Fauna is no doubt a very rich one, but owing to the stormy character of the sea, not very easy to investigate. Foraminifera are thrown up on the strand in enormous numbers. The Flora is restricted in number of species, but interesting in many ways. I have already spoken of the ferns; among other noticeable plants are *Gentiana verna*, Sea Kale growing among the loose stones of the shingle banks, and the common Ragwort, or *Senecio Jacobæa*; this is noticeable from the fact that in the majority of specimens the flowers are without the ordinary bright yellow

ray, and it requires a little examination at first to convince oneself that a new and strange species has not been discovered.

Many of the references I have now to make to the earlier history of Aran are taken from an account compiled by Martin Haverty from the reports in the *Freeman's Journal* of an excursion to Aran by the Ethnological Section of the British Association in the year 1857.

The earliest reference to the pre-Christian history of Aran is to be found in the account of the battle of Moyturey, in which the Firbolgs, having been defeated by the Tuatha-de-Danauns, were driven for refuge to the islands off the west coasts of Scotland and Ireland. It is probable that the date of the erection of the Doo Caher, or Black Fort of Aran was shortly after this period. This battle is supposed to have taken place considerably more than 1,000 years before the birth of Christ. At all events, this structure is evidently of much older date than the other forts which I shall presently mention, and the date of which can be fixed pretty definitely as the first century of the Christian era, and which were built by the same sept of Firbolgs, who about this time were driven out of the Scottish islands by the Picts or Chrithmians. The Firbolgs, under their chieftans Conchovar, Ængus, and Mil, the three sons of Uamore, returned to Ireland, the country of their ancestors, and settled for a time in Leinster. They were, however, compelled to relinquish the land they held there by the exorbitant rent exacted for it by Cairbre, the king of Tara—by the way, this shows how history repeats itself, and that the grievances of to-day were the grievances of twenty centuries ago—and crossed the Shannon into Connaught, where a great part of the population still belonged to their own ancient race. Here they were well received by Queen Maeve, who granted them the Islands of Aran, where they immediately fortified themselves in great stone duns or forts, which must at that time have been almost impregnable, and the remains of which are, at the present day, probably the grandest ruins of the kind to be found in the world. The names of those chieftains are still to be found in the names of Dun Ængus, Dun Conchovar, and Muirveagh Mil, or sea plain of Mil. I need hardly say that the early facts of Irish history are no more to be accepted without the proverbial grain of salt than those of other countries, but there seems to be at all events some foundation for most of the statements which I have now made. The authorities for these statements are to be found in O'Flaherty's *Ogygia* and *Jar-Connaught*, and in an Irish MS. tract, by McFirbis, on the Firbolgs, who refers to the older authorities.

(To be continued.)

THIRTY-SECOND ANNUAL REPORT
OF THE
BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL
SOCIETY,

PRESENTED BY THE COUNCIL TO THE ANNUAL MEETING,

FEBRUARY 3RD, 1891.

The Council have the pleasure of reporting, respecting the position of the Society, that the number of members has been fully maintained during the past year; and they have been enabled to pay off all the remainder of the loans that were contracted three years ago, thus making the Society entirely free from debt.

The Council refer with special pleasure to the Muybridge Lectures on the "Motion of Animals," illustrated by remarkably fine lantern views, that were delivered on March 12th and 14th, in the Town-Hall, under the auspices of this Society, the Mayor and Sir Thomas Martineau taking the chair on the two occasions. These lectures not only gave great pleasure and interest to the members and a large attendance of the general public, but by the surplus receipts from them they have enabled the Council to pay off entirely the loans contracted by the Society. For this the members are indebted to the President (Mr. C. Pumphrey), Mr. Grove, and Mr. Wilkinson, and the several members who joined in a voluntary guarantee fund, by means of which the lectures were carried out without any liability being incurred by the Society, the gratifying financial result being specially due to the personal exertions and excellent management of the President and Mr. Grove.

The Council tender their thanks to the donors of the various gifts to the Society that are named in the reports of the Sections, and especially to Mr. Hughes for his present of a portrait of Miss Naden, and a photographic group of the members who formed the Falmouth Marine Excursion in 1879; to Dr. Milnes Marshall for the copy of his "Studies from the Biological Laboratories of Owens College;" and to Mr. Burgess for his microscope slide of fifty species of Foraminifera from Hammerfest, Norway.

The Council are gratified in recording the completion of the great work by Mr. Bagnall, the "Flora of Warwickshire." With him it has been a labour of love, but it nevertheless represents years of arduous toil; and, while it reflects great honour on Mr. Bagnall, the Council feel that the Society which numbers him amongst its active members enjoys a

share in the credit of his work. The publication of the first complete Flora of the county by one of our members is an important event in the history of the Society; and this Flora is, in the estimation of competent judges, not inferior to any County Flora that has been published.

The Annual *Conversazione* of the Society was held on October 28th, in the Examination Hall, Mason College, and was largely attended. Mr. Councillor Wallis kindly lent a very interesting and beautiful series of coloured drawings of scenes in India, Ceylon, China, Japan, &c., that had been drawn by himself during a tour round the world. Mr. Chase exhibited his unequalled collection of young birds in the down, most beautifully prepared in separate groups. A fine collection of butterflies was shown by Mr. George Kenrick; two living albino specimens of the song thrush, which had been reared and kept by him for three years, were contributed by Mr. Hague; a collection of British birds' eggs by Mr. Hodgson; living ants' nests by Mr. Martineau; a marine aquarium by Mr. Blakemore; and specimens of remarkable rocks from Norway by Dr. Lapworth. A number of stereoscopic and other photographs by Mr. Watson, and a variety of photographic lantern slides were exhibited; and a large and interesting collection of objects under microscopes.

An excursion was made to Broadway, on Monday, June 7th. This was joined in by about fifty members and friends, and was successful in every way, thanks to the excellent management of Mr. Levick. The weather was most favourable, the scenery delightful, and, with the pleasant arrangements at the Lygon Arms, made the visit thoroughly enjoyable.

The Treasurer's annual financial statement shows the receipts of the Society for the past year to have been £181 17s., and the payments £167 5s. 1d., including the repayment of the three remaining £10 loans, and leaving a balance in the Treasurer's hands of £14 11s. 11d., in place of a deficiency of £4 9s. 1d. at the end of the previous year. The Council specially congratulate the members on this very satisfactory financial position of the Society.

The total number of members for the year 1890 is 204, being 2 more than in the previous year; of this total, 7 are life members, 142 ordinary (guinea) members, 12 family (half-guinea) members, 7 lady (half-guinea) members, 5 honorary vice-presidents, 25 corresponding members, and 6 associates.

The thirteenth Annual Meeting and *Conversazione* of the Midland Union of Natural History Societies was held at Leicester on September 18th and 19th. The President and

Mr. Edmonds represented this Society at the meeting. Excursions, botanical and geological, were made to Charnwood Forest.

MICROSCOPICAL SECTION.—President, Mr. C. Pumphrey ; Secretary, Mr. W. H. Wilkinson.—During the year nine meetings of the section have been held, with an average attendance of thirty-one ; and the following communications have been made :—

March 4th.—“On Painting Lantern Slides direct from the Microscope,” by Mr. H. M. J. UNDERHILL, of Oxford. Read by Mr. W. P. Marshall.

April 1st.—“Optics of the Microscope,” illustrated by drawings and lantern photographs, by Mr. J. EDMONDS. The lime-light lantern worked by Mr. C. Pumphrey.

April 29th.—Mr. W. B. GROVE gave the Retiring President's Address on the “Theory of Instinct,” which was listened to with great attention and interest.

May 6th.—“Report on the Foraminifera obtained at Hammerfest by Messrs. Pumphrey and Marshall,” by Mr. E. BURGESS. Read by Mr. W. H. Wilkinson ; and a slide, containing fifty species, mounted by Mr. Burgess, was presented to the Society.

June 3rd.—“Corals, Coral Builders, and Coral Islands,” by Mr. W. R. HUGHES, illustrated by drawings, and by specimens of coral and of coral builders preserved in spirit.

November 4th.—“Reflectors as used with the Microscope,” illustrated by various mirrors and models, by Mr. W. H. WILKINSON.

December 2nd.—“Burmah and its People,” by Mr. A. W. WILLS, illustrated by lime-light views from photographs taken by himself during his recent tour there.

At the sectional meetings a large number of specimens have been exhibited, and amongst many members who have helped may be mentioned Mr. J. E. Bagnall, plates of fungi and mosses ; Mr. W. B. Grove, minute fungi ; Mr. W. R. Hughes, flowers and plants ; Mr. C. Pumphrey, Alpine and other plants ; Mr. C. J. Watson, an interesting collection of plants from Norway ; Mr. G. M. Iliff, glow-worms ; Mr. A. Reading, a scarlet fungus ; Mr. Carpenter, fine specimens of corals ; Mr. G. Lavender and Mr. T. E. Bolton, living specimens of pond-life ; Mr. W. H. Wilkinson, lichens from Norway, birds and plants from Wales, &c.

BIOLOGICAL SECTION.—President, Mr. W. B. Grove ; Secretary, Mr. A. H. Martineau.—During the past year this section has held eight meetings, at three of which papers have been read, and on every evening there has been a good display of specimens. The principal exhibitors were the following :—Messrs. J. E. Bagnall, F. W. Carpenter, J. Edmonds, T. V. Hodgson, W. R. Hughes, J. B. Stone, Herbert Stone, E. H. Wagstaff, C. J. Wainwright, C. J. Watson, W. H. Wilkinson, and A. H. Martineau. The section is also indebted to Miss

Gingell, who has forwarded specimens from Dursley, Gloucestershire. The average attendance at each meeting has been seventeen. The following is the list of papers:—

- May 13th.—“On the Flora of Sutton Park,” by Mr. J. E. BAGNALL.
 October 14th.—“On Animal Pedigrees,” by Dr. A. MILNES MARSHALL, Professor of Biology at Owens College, Manchester.
 December 9th.—“On Canadian Birds,” by Mr. J. B. WILLIAMS, jun., of Toronto.

Dr. Marshall's lecture on “Animal Pedigrees” was delivered in the Examination Hall to a large audience, and was of special interest. It was illustrated by an extensive series of very fine diagrams.

GEOLOGICAL SECTION.—President, Mr. T. H. Waller; Secretary, Mr. John Udall.—The meetings have been well attended, and the papers read have been of great interest; average attendance forty-three. The section has much pleasure in again expressing its indebtedness to the President of the Society, Mr. Charles Pumphrey, for his valuable aid in illustrating several papers read during the year; to Mr. T. H. Waller for bringing Messrs. J. Swift's new model microscope for petrological work before their notice, and for his description of its construction and uses; and to Dr. Lapworth for his valuable address on the geological problems presented by the arrangement of the rocks in Norway. The following papers have been read at the meetings of the section during the year.

- January 21st.—“The Magnesian Limestones of Durham,” by Mr. C. J. WATSON.
 February 18th.—“Some Silver Ores from the Barrier Ranges of New South Wales,” by Mr. T. H. WALLER.
 March 18th.—“A Trip to Norway and the North Cape,” by Messrs. W. P. MARSHALL and CHAS. PUMPHREY.
 April 15.—“Personal Observations of Glacial Action among British Mountains,” by Mr. HORACE PEARCE, of Stourbridge.
 May 20th.—“A Model Microscope, especially adapted for Petrological Work,” made by Messrs. J. Swift and Son, by Mr. T. H. WALLER.
 June 17th.—“The Unconformity between the Uriconian and Cambrian Rocks of Shropshire,” by Dr. CHAS. CALLAWAY.
 October 21st.—“The Bone Bed of Ludlow,” by Mr. J. UDALL.
 November 18th.—“Rocks of Norway,” by Mr. C. J. WATSON.
 December 16th.—“Crinoids,” by Mr. MADELEY, of Dudley.

SOCIOLOGICAL SECTION.—President, Mr. W. R. Hughes; Secretary, Mr. Herbert Stone.—Twenty-two meetings have been held, of which seven were ordinary and fifteen supplementary. At the ordinary meetings there has been one paper read, viz.:—

March 27th.—“Ideas of Supernatural Agents,” by Mr. W. R. HUGHES.

At the supplementary meetings the following have been read :—

January 23rd.—“Ideas of the Animate and Inanimate,” by Miss L. A. GOYNE.

February 13th.—“Ideas of Sleep, Dreams, and Swoon,” by Miss BIRT-DAVIES.

February 27th.—“Ideas of Death, Resurrection, Souls, &c.,” by Mr. HAROLD W. BUNCHER.

March 20th.—“Ideas of Another Life and Another World,” by Miss BYETT.

April 17th.—“Sacred Places, Altars, Temples, &c.,” by Mr. E. HILL.

April 24th.—“Ancestor Worship, Idol Worship, and Fetish Worship,” by Mr. J. A. HILL.

May 8th.—“Animal and Plant Worship,” by Mr. W. B. GROVE.

May 22nd.—“Nature Worship,” by Miss MARY DALTON.

June 12th.—“Deities,” by Miss MARY DALTON.

June 25th.—“On Weismann's Theory of the Continuity of the Germ Plasm,” by Mr. HERBERT STONE.

November 11th.—“Socialism; the Coming Storm,” by Mr. HERBERT STONE.

During the past year the members of the section have exhibited a marked preference for the supplementary meetings, as only one paper has been read on a Tuesday evening. It is regretted that there has been a considerable falling off in the number of papers, there being only eleven, against eighteen during the previous year.

On April 27th a memorial, signed by forty-three members and friends interested in the section, was sent to Mr. Herbert Spencer, congratulating him on attaining his seventieth birthday. A kind acknowledgment was received from him.

In the absence of the Secretary, through illness, during the greater part of the year, his duties have been discharged by Miss L. A. Goyne.

The Library.—The Librarian (Mr. J. E. Bagnall) reports that the library is in about the same condition as when last reported. It is still to be regretted that it receives so little patronage from the members. Only 81 volumes have been taken out, and the number of members borrowing these books has been only 33. The following has been the issue of books for the year :—Botany, 11 ; Entomology, 11 ; Zoology, 15 ; Geology, 7 ; Microscopy, 17 ; miscellaneous, 20.

General Property.—The Curators (Messrs. G. M. Iliff and Herbert Miller) report that the necessary repairs mentioned in their last report have been effected, and the instruments are now in working order.

THE SCOPE OF SOCIOLOGY.

BY MARY E. DALTON.

(Concluded from page 28.)

When the doctrines of Sociology were first formulated, and were found to include ethics, its claim to rank as a science was hotly disputed, because the doctrines of free will and of a moral sense were considered incompatible with complete reduction to the terms of physical science. The objection has been answered during the course of our study of the data of Sociology; we have seen that the moral susceptibilities of men are ordinary physical facts. We may go further, since, plainly, ethics cannot stand independently of politics. A delicate sympathy beats through every fibre of human association, and we trace the history of morality, not as something imposed by an external superhuman authority, but as the grown ideal which has been formed by humanity itself. The developed thought of the wisest and best of the race, even in primitive times, passed beyond the present, and saw not only what humanity could do and be as it was, but what it could do if all its units were wise and good beyond the measure they had reached; and as that ideal height of virtue was attained by the mass of mankind, it was raised still higher by the master-spirits of the age. Truth, wisdom, and righteousness came by painstaking, study, and striving, and our primitive ancestors,

“Groping blindly in the darkness,
Touched God’s right hand in that darkness,
And were lifted up and strengthened;”

they, too, had “longings, yearnings, strivings, for the good they understood not;” and in their lower degree they, too, “lived by admiration, hope, and love.” Horrible as Sociology shows the early state of our race to have been, our very comparison between the present and that distant past is full of the brightest encouragement to our highest hopes, and of the strongest incentives to constant effort in our attempt to help forward the work of the world.

The political and religious controls of societies, and the work performed by them, constitute the two most important of the “co-ordinating structures and functions,” as Spencer calls them. In addition to these is a minor system of restraints which regulates the daily activities of the citizens. These restraints, more fitful, but real and lasting in the influence they exert over conduct, are also of the nature of ceremonial observances, and were originally closely allied to

the political and religious systems of which they have now become quite independent. They owe their authority and power to the custom which sanctions them. The influence exerted over habits and conduct by codes of etiquette, and over the details of daily life by the dictates of fashion, have to be considered, although much greater in the past than in the present. No influence which helps, in however slight a degree, to mould human life can be ignored by the student of Sociology.

Having gone so far, we may fairly claim to have dealt with the governing forces of social phenomena. There remains for us to consider the structures and functions governed. For this purpose, Spencer divides all societies into two divisions, the regulative and operative divisions, and notes that the inquiries of highest importance in social science concern the relations between them. We must trace the history of industry, its slow development, and regulation by trade guilds, unions, and so forth; its relation to the ecclesiastical and political powers, and to the changing and developing nature of the citizens, there being here, as everywhere, a reciprocity of influence. We seek in Sociology for the keys by which to solve the problems caused by the present great and growing conflict between capital and labour. We find that, whereas labour *was* actual property, it is now simply an article of commerce, whose value varies, and which sometimes fails to find a purchaser. About the time when equal rights were granted to all men, a change in the methods of production entirely altered the condition of the workers—the capitalist *régime* began, and brought in its train many of our present social evils. The possession of equal political rights naturally embitters the demand for equality of conditions, and the struggle between capital and the labour which it feeds has reached an acute crisis. In our consideration of these questions, narrowly classed as “Political Economy,” we begin by tracing the separation and subsequent development of the distributive and productive systems of industry, and follow on to consider the growth of the principle of “division of labour” in each class, and of the mutual co-operation which is the natural corollary of the “division of labour.” Moreover, we must consider the effects which the many varied industries of civilised life produce on each other; the advance and improvement caused by their mutual help and interdependence. Here again we find the strength of unity:—

“All are needed by each one;
Nothing is fair or good alone.”

Having considered the organisation and life of each society, as developed by social evolution, there remain to be con-

sidered the closely associated developments of language, knowledge, morals, and æsthetics.

We trace the development of language from simple sounds expressing sense perceptions, to the complex words by which the most abstract conceptions of human thought are expressed; of knowledge, from the simple explanations of the action of surrounding life and nature which the primitive savage verified and confirmed by repeated observation, to the reasoned hypotheses of the Synthetic Philosophy itself; of morals, from the self-respecting instinct of physical man, to the altruistic sentiments of the more developed human being; of æsthetics, from the play-impulses which led to a simulation of pleasurable activity, in mental faculties which had been too long dormant, to the highest excellence which has been reached in the fine arts.

We have now, then, examined the "scope" of our science of Sociology in detail; the result is that we find ourselves in infinity. We cannot find the beginning of our knowledge, and we cannot trace its end.

The study of Sociology is the coping stone of our palace of Evolution; the building is insecure if a single stone of knowledge is omitted or misplaced. We are in the habit of looking at society, and especially at the political and religious constitution of things, and their record of a few thousand years; and the record seems vast, and the society a stable and permanent—even a necessary—part of the cosmos: we look at the same phenomena as subjects for scientific enquiry, and all is changed. We find we are looking at a changing, growing, and developing *living* organism, the history of whose life is known to us only as the history of hours out of countless ages; but of which even that limited knowledge enables us to see that the progression has been gradual and orderly, the connection between cause and effect absolute and unchangeable. We trace the growth of the present complex conditions of life back to forms of great simplicity, widely modifiable by circumstances, and only acquiring stability and permanence after long and slow process of accommodation to the environment. But the progress has been unceasing, and retrogression has been only apparent.

In our study of the Data of Ethics we saw that so great has been the triumph of mind over matter during the last century, that man's social environment has actually temporarily outstripped in its development the capacity of the human organism for adaptability, and so checked progress for the time being; this has been the case also at preceding stages in the process of Evolution. Many times, even to the primitive savage, the social environment was beyond that to

which he was fitted. But we see that the check was only temporary. Arrest of progress may come to a nation, but humanity is ever moving onward. Assyria, Babylon, Egypt, Greece, and Rome, pass away, as did the less civilised nations who preceded them; but all that they achieved is part of the lasting progress of the world, and that, from the dim past, in which our "social" foundations were laid, has been—slow and gradual, but unceasing—a growth towards a perfection whose beginning we do not know and whose end we cannot guess.

Biology has taught us that Evolution has already done much in working out the beast in man's lower physical nature; Sociology tells us that the same Evolution is still actively energetic in working out his higher perfection too, and in bringing about that perfect social state for which only a perfect human being is fitted. A comparison of results suggests the belief that man is even yet only at the dawn of his full day; and fills us with the faith that, as Tennyson puts it:—

"This fine old world of ours is but
A child yet in the go-cart."

Having given us the data and the scope of Sociology, Spencer finishes the introduction to his work by what is really a note of warning against the danger of isolating any one set of phenomena, by reminding us that "the highest achievement in Sociology is so to grasp the vast heterogeneous aggregate, as to see how the character of each group at each stage is determined, partly by its own antecedents, and partly by the past and present actions of the rest upon it."

The motto of old science was: "Isolate the phenomena to be studied;" the motto of modern science may well be the direct opposite of this. In proportion as everything is known, any one thing is known better; all knowledge is relative, and only omniscience could rightly and completely know anything. Until we have taken in all the relations, immediate and remote, into which a thing, actually or potentially, enters, we do not know *all* about the thing—but for such an exhaustive acquaintance, an acquaintance with every other thing, actual and potential, near and remote, is needed. In the true spirit of our evolutionary science, Tennyson sings:—

"Flower in the crannied wall,
I pluck you out of the crannies;
I hold you here, root and all, in my hand,
Little flower—but *if* I could understand
What you are, root and all, and all in all,
I should know what God and man is."

Spencer is continually insisting—especially in connection with the study of Sociology—that this is a world of relations. We are continually reminded of the truth of Aristotle's famous dictum that "a hand amputated is not even a hand." In proceeding to the study of Sociology by inductive and deductive process of reasoning and proof, we must isolate no set of phenomena, we must neglect no fragment of knowledge. No single fact, no single truth, stands alone, and no fact and no truth is unimportant or insignificant.

"There is no great and no small
To the soul that maketh all :
And where it cometh, all things are,
And it cometh everywhere."

"The progress of the intellect," says Emerson in his essay on History, "is to the clearer vision of causes which neglects surface differences ; to the poet, to the *philosopher*, to the saint, all things are friendly and sacred, all events profitable, all days holy, all men divine. For the eye is fastened on the life, and slights the circumstance. Every chemical substance, every plant, every animal in its growth, teaches the unity of cause, the vanity of appearance."

In biologic study "genius detects through the embryo the constant individual ; through countless individuals the fixed species ; through many species the genus ; through all genera the steadfast type ; through all the kingdoms of organic life the eternal unity." And so with the great study of Sociology, of which all other knowledge, and all other sciences, are but parts. Beyond all visible phenomena is the Unknown First Cause, and in seeking to understand these we are examining what Goethe well called "the woven garment of God."

"The revelation of God," said a great modern thinker, "is the continuous thought of man : " accepting that dictum, we pass to "higher reverence unmixed with fear." With balanced enthusiasm and sympathetic interest we study the present in the light of the past ; and the past with that carefully constructive imagination which alone enables us to see it as it was.

"The noblest study of mankind"—we may adapt the hackneyed quotation to our own purpose—is humanity, and to this all other study is rightly subservient. If the subject is so vast, and the need for patient thought and endeavour so great that our finite minds falter for a moment at contemplating the work we have undertaken, we may console ourselves by remembering that the materials for sociologic study are always with us. Men help as much as, or even more than, books ; and the most trivial action of our daily life is of historic interest as the result of long development.

The result of our study, too, is full of helpful encouragement. The pessimist may talk of the world as hopeless, and life as dark and dismal, but the Sociologist recalls his knowledge of what the world *has* been, contrasts the present with the past, and feels inclined to echo with Homer's hero, "We are thankful to Heaven that we are worth infinitely more than those that went before us." Certainly we know enough of the past and present history of mankind to believe that our highest ideal of human perfection is but the prophecy of the coming man, to whom duty will be instinctive, and whose law will be, in very deed, the law of righteousness. All the facts of Sociology emphasise the truth of what George Eliot says:—

"The faith that life on earth is being shaped
To glorious ends; that order, justice, love,
Mean man's completeness, mean effect as sure
As roundness in the dewdrop: that great faith
Is but the rushing and expanding stream
Of thought and feeling fed by all the Past."

May not the student of Sociology add, with the Poet-Laureate—

"My faith is large in time, and that which
Shapes it to some perfect end?"

THE FUNGI OF WARWICKSHIRE.

BY W. B. GROVE, M.A., AND J. E. BAGNALL, A.L.S.

(Continued from page 24.)

Genus XIII. LENTINUS. *Fr.*

480. *L. tigrinus*, *Fr.* *Ag. tigrinus*, With., 155. Packington Park, amongst moss, *With.*
481. *L. lepideus*, *Fr.* Fine specimens of this species abundant in a cellar at Selly Oak, growing on the rafters of the floor above. Selly Oak is in Worcestershire; but what is believed to have been a monstrous form occurred in a wine cellar at Edgbaston, and in a manufactory in the heart of Birmingham.
482. *L. adhærens*, *Fr.* *Ag. adhesivus*, With., *Purt.* Sept. Red Rock Plantation, Edgbaston, *With.*, 158. Ragley Park, *Purt.* iii., 187.
483. *L. cochleatus*, *Fr.* *Ag. cornucopioides*, *Purt.* Sept.-Oct. Ragley Woods, *Mrs. Rufford in Purt.* iii., 190. Trickle Coppe; New Park, Middleton.
484. *L. flabelliformis*, *Fr.* *Ag. reniformis*, *Purt.* June. Wixford, *Purt.* ii., 658.

Genus XIV. PANUS. *Fr.*

485. *P. conchatus*, *Fr.* *Ag. conchatus*, *With.*, *Purt.* August to November. Edgbaston, on large trees, *With.* 295. On a lopped poplar at Studley, *Purt.* ii. 656. Solihull, *Hawkes!* Driffold Lane, Sutton.
486. *P. torulosus*, *Fr.* On stumps. July to October. On a stump, The Briars, Kenilworth, *Russell, Illustr.* Hopsford, near Brinklow, *Adams!* Gorsy land, Billesley, near Alcester; Packington Park; Driffold Lane, Sutton.
487. *P. stypticus*, *Fr.* *Ag. ficoides*, *With.* On stumps. On an alder stump in Edgbaston Park, *With.* 298. Near Warwick, *Perceval.* Kenilworth, *Russell, Illustr.* Hopsford, near Brinklow, *Adams.* Driffold Lane, Sutton, abundant.

Genus XV. SCHIZOPHYLLUM. *Fr.*

488. *S. commune*, *Fr.* On logs. Very rare. On a felled oak, Shustoke, April, 1888. Certainly indigenous.

Genus XVI. LENZITES. *Fr.*

489. *L. betulina*, *Fr.* On felled timber. September to February. Hopsford; Combe, *Adams.* Near Solihull Railway Station, 1871; Hartshill Hayes; Sutton; Sutton Park; Marston Green; Packington Park, &c.
490. *L. flaccida*, *Fr.* On stumps. Rare. Near Warwick, March, 1872, *Perceval.*
491. *L. sepiaria*, *Fr.* On fir wood. Rare. Combe Woods, *Adams.* Sutton, on larch.

ORD. II.—POLYPOREI.

Genus XVII. BOLETUS. *Dill.*

492. *B. luteus*, *Linn.* Woods. Local. October. Sutton Park; Trickley Coppice; pine wood near Coleshill Pool; wood, Maxstoke.
493. *B. elegans*, *Schum.* Borders of woods. Rare. October. Pine wood near Coleshill Pool; Trickley Coppice.
494. *B. flavus*, *With.* Woods. Frequent. August to October. Edgbaston Park, *With.* 314. Oversley Hill! Ragley Woods! *Purt.* ii. 665. Warwick, *Perceval.* Kenilworth! *Russell, Illustr.* Hopsford, *Adams.* Sutton Park; Trickley Coppice; Coleshill Pool and Heath; Ironstone Wood, Oldbury; Waverley Wood, Stoneleigh; Baddesley Clinton; Haywood; Old Park Wood, Arrow; Hampton; Earlswood; Bradnock's Marsh; Marston Green; Fen End; Umberslade; Corley; railway cutting near Henley-in-Arden; Solihull.

495. *B. granulatus*, Linn. *B. lactifluus*, With. Woods, &c. August to October. Edgbaston Park, *With.* 314. Ashow, *Russell, Illustr.* Trickley Coppice; Olton Reservoir; Coleshill Heath.
496. *B. bovinus*, Linn. Pine woods. September-October. Trickley Coppice, Middleton; pine plantation, Coleshill Heath.
497. *B. badius*, Fr. Woods. Not uncommon. September-October. Crackley Wood! *Russell, Illustr.* Sutton Park; Trickley Coppice; New Park; Coleshill Pool and Heath; Bradnock's Hayes; Corley; Edgbaston Park.
498. *B. sanguineus*, With. Woods. Rare. October. Edgbaston Park, *With.* 313. Oversley Hill, *Purt.* ii. 664. Crackley Wood, *Russell, Illustr.* The Fields, Ansty, *Adams.* Packington Park.
499. *B. piperatus*, Bull. Woods. August-September. Combe Ridings, *Adams.* Trickley Coppice, Middleton; Sutton Park; Berkswell.
500. *B. variegatus*, Sw. In pine woods. Rare. August. On the borders of Coleshill Pool.
501. *B. striæpes*, Secr. Woods. Local. October. Near Kenilworth! *Russell, Illustr.* Sutton Park; New Park.
502. *B. chrysenteron*, Fr. Woods. Frequent. September-October. Crackley Wood! *Russell, Illustr.* Warwick; The Spring, Kenilworth, *Perceval.* Combe Woods! *Adams.* Sutton Park; New Park; Trickley Coppice; Bradnock's Marsh; Coleshill Heath; Water Orton; Corley; Coughton Park, &c.
503. *B. subtomentosus*, Linn. *B. chrysenteron*, With. Woods. Frequent. September-October. Edgbaston, *With.* 313. Ragley Woods! Oversley Wood, *Purt.* iii. 241. Lodge Wood, Warwick, *Perceval.* Kenilworth, *Russell, Illustr.* Hopsford, *Adams.* Sutton Park; New Park; Trickley Coppice; pine plantation, Coleshill Heath and Pool; Crackley Wood, Kenilworth; Berkswell; Bradnock's Marsh; Packington Park; Edgbaston Park, &c.
504. *B. rubinus* Smith. Rare. Waysides. By Washpit, Brinklow Lane, near Combe, *Adams.*
505. *B. parasiticus*, Bull. On *Scleroderma*. October. New Park, October, 1884! *Cooke.*
506. *B. varicolor*, B. et Br. Woods. Rare. Combe Woods, *Adams.* Bank of a field, border of Packington Park, August, 1886.

507. *B. calopus*, Fr. *B. olivaceus*, var. 2, With. Packington Park, With. 312. Withering quotes Schæff. t. 315, so that he may possibly have found this species.
508. *B. olivaceus*. Schæff. Woods, &c. October. Church Lane, Edgbaston, With. 312.

(To be continued.)

A VISIT TO THE NORTH CAPE AND NORWAY, ILLUSTRATED BY A SERIES OF 150 LANTERN SLIDES.

BY C. PUMPHREY AND W. P. MARSHALL.

(Concluded from page 35.)

- 63.—Is a photograph of some Monkshood (*Aconitum septentrionale*) that we saw growing very luxuriantly near Fladmark, the plants 6ft. in height, with leaves 2lin. across.
- 64.—The *Linnea borealis*, with its lovely little pink flowers, was abundant in several places, and is interesting as the only plant that Linnæus named after himself.
- 65.—Sletta Fos, in Romsdal, where the Rauma makes a picturesque waterfall through a narrow passage in the rocks.
- 66.—Vermes Fos, another waterfall in Romsdal. The waterfalls form a very beautiful feature in Norwegian scenery, and they are very numerous, hundreds being seen in each day's journey. Norway has been truly called the "land of waterfalls."
- 67.—A nearer view of Vermes Fos Waterfall.
- 68.—Romsdal cliffs, at Horgheim, where we stopped the next night, after having been to the summit of the pass, where the road rises to 2,000ft. above the sea. In the front is the hotel, or "Station," as it is called, where we stayed.
- 69.—Soeholt, on the Stor Fjord, where we stopped a night. In the front are two "Carrioles" the other kind of vehicle which carries only one passenger each, with the post-boy or "skydsgut" hanging on behind.
- 69A.—Soeholt, from the steamer.
- 70.—Group at Soeholt, grinding scythe blades. They have two kinds of scythes, a large one, double-handed, like our mowing scythes, and a small one, used with a single hand, having a small sickle blade at the end of a long handle, which is used for mowing the grass in the small rough places where there is not room for the sweep of a scythe; great pains are taken to grow grass for hay in every possible place, however rough.
- 71.—The Geiranger Fjord, one of the most favourite places in Norwegian scenery; showing the beautiful reflections in the water that are seen on a fine day.
- 72.—A further view of Geiranger Fjord.
- 73.—First view of the celebrated Seven Sisters' Falls in Geiranger Fjord.
- 74.—Nearer view of the Seven Sisters' Falls; these fall over a cliff of more than 1,000ft. in height from the water, and the total height is as much as 3,000ft. of the mountain cliffs on each side. These fine views of Geiranger were taken by Dr. Anderson.

- 75.—Moelkevold Brae Glacier, at the head of the Olden Lake, with a farm cart and peasants in the foreground.
- 76.—The first sight of the great Brixdal Glacier, which is one of the largest of those flowing from the extensive Jostedal Snowfield, which is nearly fifty miles in length, and has many glaciers flowing from it.
- 77.—The foot of the glacier, showing the cave from which the stream flows.
- 78.—Close view of the foot of the glacier.
- 79.—View at the edge of the glacier.
- 80.—View across the glacier, showing the upper part.
- 81.—Fjord near Olden, showing farm building with turf roof and trees growing upon it, The houses are roofed with birch bark, laid on in many layers overlapping one another to a total thickness of about four inches, and thoroughly water-tight, and then a thick layer of turf is put on to prevent the bark blowing away, and on this turf grows a crop of plants, flowers, and even small trees. In one case, we saw a couple of kids browsing upon the roof of a house. These roofs are very durable, and last out the timber walls of the houses.
- 82.—A scene in Oldendal, showing the remains of one of the curious little vertical mills. The supply of water power is very abundant throughout the country, and a small stream is led down a shoot upon the oblique vanes of a small water-wheel that is fixed upon a vertical spindle. On the top of this spindle a millstone is fitted, forming the whole machinery of a corn mill; or a pulley, as in this photograph, for driving a circular saw to cut up timber.
- 83.—Shows one of the mills, with the water turned off for the time, and flowing over the side of the shoot. These mills for grinding corn and cutting timber are very plentiful throughout the country, as the farmers have generally to grind their own corn, and all the buildings are of wood, for which the timber has to be cut.
- 84.—Scene on the road to Faleide, with our Stolkjaerre, and a girl or "pige" for the driver.
- 85.—Scene at Faleide, with a group of native tourists from the Hardanger district. The Faleide Hotel, seen at the top, has a fine situation, and is a favourite place for visitors to stay at, and to make a centre for excursions; the excursion to Brixdal Glacier is made from there.
- 86.—Utviken, beyond Faleide, showing one of the wattled fences of the country, constructed like basket-work.
- 87.—View on the pass from Utviken to Red.
- 88.—Panorama at the summit of the pass, which is an ascent of 2,200ft. A patch of snow remained in a hollow at the side of the road at the summit, although it was a hot summer day, and the thermometer was at 77° when we left Faleide in the morning. The road is terribly steep in the descent to Red, from the summit of the pass; we had been down some very steep roads before, that measured 1 in 5 for the inclination, down which the sturdy, sure-footed little ponies trotted without hesitation, but this was actually as steep as 1 in 3½ as we found by measurement, and the pony condescended to walk down, and we walked down also at the worst places.
- 89.—The "Norske Hestman," or Northern Horseman, a striking mountain, seen across a lake.
- 90.—Lake and mountain scene on the road to Vadheim.

- 91.—Another view along the shore of the same lake, or “Vand,” which is one of the inland freshwater lakes.
- 92.—Road approaching Vadheim.
- 93.—Distant view of Heldre Fos Waterfall from the road. This shows one of the older fashioned Stolkjaerres without springs; the seat is fixed upon the back end of two wood bars, which are slipped into sockets upon the long, slender shafts, and the combined effect is a certain amount of springiness, that makes the riding fairly comfortable, although there are no springs. This kind of vehicle takes all to pieces when stowed away. At one station where we had to change vehicle as well as horse, there was at first no fresh vehicle to be seen; but then a man came bowling along a pair of wheels on their axle; then he brought out of a shed, on his shoulders, a pair of shafts, with a couple of bars connecting them, dropped them on to the axle, and attached them by two wood pegs through holes in the axle; finally, he brought the seat and footboard, with the two long bars fixed to them, and slipped these into the sockets upon the shafts—and there was the carriage complete.
- 94.—Another view of Heldre Fos Waterfall seen across the lake.
- 95.—Langlands, on the road to Vadheim. We then went by steamer a long distance from Vadheim to Laerdalsoren, up the great Sogne Fjord, the largest of the Norwegian fjords, which extends as far as 100 miles from the sea to the farthest extremity of its numerous branches. Some idea of the Norwegian fjords is given by the Scotch lochs on the west coast of Scotland, such as Loch Long and Loch Fyne; but the longest of these, Loch Fyne, is only forty miles in length, and the Norwegian fjords are much more lofty in the sides and grander in scenery, and they have the striking addition of the glaciers and the numerous waterfalls.
- 96.—The landing at Laerdalsoren from the Hardanger Fjord steamer.
- 97.—Bridge at Nedre Hoeg, near Laerdalsoren.
- 98.—Sukem Fos Waterfall, near Laerdalsoren, showing the cloud of spray rising from the fall. We then started on an excursion up the Jostedal Valley, which was reached by a small coasting steamer from Laerdalsoren. We stayed two nights in the valley, and went to the great Nigaards Brae Glacier, which is one of the numerous glaciers that descend from the Jostedal Snowfield, and is on the opposite side of it to the Brixdal Glacier that we had previously visited.
- 99.—A view in Jostedal. The valley is thirty miles in length to the Nigaards Brae Glacier, and strikingly picturesque in character, with great variety of scenery. It is out of the line of ordinary tourists. The little station or inn near the head contained only two bed rooms (but beautifully clean and neat), and the visitors' book had only thirty names of visitors in it since the beginning of the year.
- 100.—Another view in Jostedal, showing one of the steep bits in the road, where it has been squeezed in between the rocky cliff and the torrent below, and the road suddenly pitches down a very steep incline.
- 101.—A view in one of the more open spaces in the valley, where there are several small farms, with fields of corn and hay.
- 102.—A view showing the road creeping round a corner of the rock, with the stream below.
- 103.—View showing the mountains towards the head of the valley.
- 104.—First sight of the Nigaards Brae Glacier, flowing down a side valley from the great snowfield.
- 105.—Close view, upon the glacier.

- 106.—Another view upon the glacier. These two photographs were taken upon the glacier, taking the camera on to the glacier, by cutting steps some way up the ice slope.
- 107.—Naero Fjord. We went by steamer from Laerdalsoren to the Naero Fjord, which winds between lofty, precipitous rocks for eight miles in length, and presents a beautiful variety of scenery. The Naero Fjord, and the Naerodal beyond it, are two of the special attractions in Norwegian scenery.
- 108.—The landing at Gudvangen, at the head of the Naero Fjord.
- 109.—View in the Naerodal.
- 110.—Another view in the valley.
- 111.—Jordalsnut, a remarkable mountainous rock, 3,600ft. high, that stands isolated in the middle of the valley.
- 112.—View from the head of the valley, showing Jordalsnut standing up in the centre.
- 113.—View from Stalheim Hotel, which stands at the head of the valley, and commands a very striking and unique view of a great portion of the valley, which is eight miles total length. Stalheim Hotel is reached by a very steep, zigzag road, that rises 800ft. up a steep rock forming the head of the valley. It is a large, commodious hotel that is a favourite place for staying at.
- 114.—View of the side of Stalheim Hotel.
- 115.—Stalheim Fos Waterfall at the head of the valley.
- 116.—Matro Fos Waterfall on the road to Eide.
- 117.—Svinde Fos, another waterfall on the road.
- 118.—Loenhorgen, a mountain 4,500ft. in height, passed on the road.
- 119.—Bridge at Voss.
- 120.—Skjeiven Fos, a remarkable waterfall over the centre of a large semicircular amphitheatre of rocks, forming a grand scene. The road crosses by a bridge above the waterfall, and finds its way to the bottom by a long series of remarkable zigzags, that double back upon themselves in a bewildering way.
- 121.—View of the waterfall from the foot of the upper fall.
- 122.—View of the lower and upper falls.
- 123.—Eide, with a sight of Eide Fjord beyond. Eide is charmingly situated at the head of one of the branches of the great Hardanger Fjord, which extends to a total distance of eighty miles from the sea.
- 124.—View of Eide, from the steamer. It is a very pleasant and convenient place to stay at for excursions.
- 124A.—Vik in Eidfjord.
- 125.—Salmon trap near Vik, made of rough stone dams, wide apart at the lower end and terminating in the rat-trap entrance of a large circular iron cage, out of which there is no escape, and the fisherman takes the fish out at his leisure, and his prey is secured. In another kind of trap that we saw, large white-painted boards are placed at the bottom of the water, and when the fish pass over they are seen by a man stationed on a high scaffolding at the edge of the water, and he has ropes attached to nets, which are then drawn up behind the fish, and the fish are secured.
- 126.—Voerings Fos Waterfall; this is one of the most celebrated of the Norwegian waterfalls, and is seen by a day's excursion from Eide.
- 127.—View at the foot of the waterfall; the height of the fall is 500ft. From Eide we went to Odde, at the head of another branch of the Hardanger Fjord, for the purpose of seeing the Buar Brae Glacier, and the Gorsvingane Pass, with the fine waterfalls on the road.

- 128.—View across Sandven Lake, on the way to Buar Brae.
- 129.—The glacier in the distance from the lake.
- 130.—Boat landing from the lake for Buar Brae.
- 131.—The Jordal route to Buar Brae.
- 132.—Jordal and the stream from Buar Brae.
- 133.—View across Jordal.
- 134.—Buar Brae Glacier.
- 135.—Foot of the glacier.
- 136.—Upper part of the glacier.
- 137.—View of Odde and the Soer Fjord; this is a beautiful situation, and a convenient place for making excursions.
- 138.—Back of Odde.
- 139.—Rocks and wood near Odde.
- 140.—Boulders in Hildal near Odde.
- 141.—Hildals Fos Waterfall near Odde.
- 142.—Bridge and valley near Odde.
- 143.—Lote Fos Waterfall on road to Gorsvingane; this is the first of three fine waterfalls near together, and shows the clouds of spray rising from the fall.
- 144.—Espilandes Fos Waterfall.
- 145.—Skars Fos Waterfall.
- 146.—Winding road and valley near Gorsvingane.
- 147.—Summit of the Gorsvingane Pass, nineteen miles from Odde, where the road is 3,400ft. in height above the sea, and rises to that extent from Odde, having in its course two very remarkable sets of steep zigzags.
- 148.—The last slide shows a native of the Hardanger district, with the peculiar head-dress called a "skaut," which is worn only by married women; it is an elaborate, pleated and starched structure, that is highly prized by the native ladies.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—February 10th. BIOLOGICAL SECTION.—Mr. John F. Goode (Vice-President) in the chair. Mr. A. H. Martineau exhibited some specimens of the Eyed Hawk-moth (*Smerinthus ocellatus*), and the Lime Hawk-moth (*S. Tiliæ*). Mr. Charles Pumphrey then read a most interesting paper, by Mr. Arthur Hunt, of Durban, Natal, entitled "Natural History Jottings in Natal," being a graphic description of observations from nature in the South African bush. At the termination of the paper a cordial vote of thanks was accorded to Mr. Hunt.—February 17th. GEOLOGICAL SECTION. Mr. T. H. Waller, B.A., B.Sc., in the chair. Mr. John Garner, M.R.C.S., L.S.A., was proposed a member of the society. Mr. C. T. Parsons exhibited some beautiful opals from Queensland. One specimen had the ferruginous matrix adhering to it. The opals seem to be found in ferruginous nodules and bands filling either cavities or cracks, and not in volcanic rock, as seems usual in Hungary. Mr. C. J. Watson then showed and described a series of lantern views of Norwegian scenery taken during the excursion of the Vesey Club last summer.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—Jan. 19th. The meeting was only of a formal character, the members having been invited to the Entomological Society's *conversazione*.—Jan. 26th. Mr. J. Collins read a paper, "Notes on some Plants from North Wales." The writer said his intention was to describe some plants found in a ramble extending over a few days in the month of July, and, though the district could not be called remarkable for its rare plants, yet few could describe the pleasure it gave a botanist to meet with those he had not seen before. The ramble commenced at Llanfairfechan and was continued along the coast line to Bangor, then inland to the mountains, and back to Conway. The formation worked was mainly Cambrian, the mountain limestone being crossed in a few instances. The country inland was very wild and in its primitive state. The mountains were very rich in bog plants. One of the most remarkable finds was a bed of cultivated musk, far away from any human habitation save a shepherd's hut; and, as this is not a native plant, it was interesting to find it so well established. On the ruins at Conway were found plants it was difficult to account for, unless they were introduced by the monks centuries ago for medicinal purposes. The plants were handed round during the reading of the paper.—Feb. 2nd. Mr. R. Birbeck exhibited a collection of butterflies, beetles, and reptiles, from the West Indies. Mr. Linton, a series of objects illustrating the life history of the silkworm (*Bombyx mori*), also a collection of British birds' eggs; Mr. Deakin, fossils from Woolhope limestone, Hay Head, near Walsall; Mr. J. Moore, burying beetles (*Necrophorus ruspator*, *N. vespillo*, and *N. humator*); Mr. A. Camm, a series of drawings of Myxomycetous fungi; Mr. J. W. Neville, leaf of an Australian *drosera*.—Feb. 9th. The President, Professor Hillhouse, M.A., F.L.S., showed a sapling of birch entwined with honeysuckle. Though the stem of the latter was very thin, it had so constricted the stem it climbed as to form a congested spiral growth. Mr. C. P. Neville then gave a lecture on "The Hand-camera," with lantern illustrations. After reviewing the strength and weakness of various makes of cameras, a small hand-camera was recommended. It had been tested in many ways and had given good results. A large series of pictures showing its successes and failures were put on the screen. They comprised for the most part views in Wales, and showed breaking waves, morning, evening, and sunshine effects. A discussion followed the views, in which the President, Mr. J. Edmonds, and Mr. Camm took part. The lecturer said he did not place this camera in competition with more costly ones for the beauty of its work, but rather recommended it for its simplicity and portability.—Feb. 16th. Special.—Conchology. Mr. J. Madison showed a case of shells, including all the British species of *Planorbis*, also several species from America and Australia, and some fossil representatives; Mr. S. White, a collection of marine shells from Blackpool; Mr. P. T. Deakin, marine shells from Malta; Mr. Linton, American and West Indian shells; Mr. J. H. Corbett, fossil shells from oolite and shelly limestone; Mr. J. Collins, unusual variety of *Helix aspersa*, from Torquay; and *Limnæa stagnalis*, from Kew Gardens.

OXFORD NATURAL HISTORY SOCIETY.—January 23rd. The annual meeting was held in the Large Lecture Theatre at the Museum, when Professor A. H. Green, M.A., F.R.S., was elected president, in the place of Mr. E. B. Poulton, M.A., F.R.S., who had most ably held the office since the establishment of the society in 1887. Mr. G. C. Druce, M.A., F.L.S., was unanimously re-elected treasurer.

His report showed the society to be in a flourishing condition, having a considerable balance in hand. The election of a secretary, to succeed Mr. Underhill, was deferred until the next meeting. At the close of the business, the members adjourned to the corridor, where refreshments were kindly provided by Mr. Poulton, and a pleasant evening was spent. The Radcliffe Library and the Hope Collection of Insects were open by kind permission of Sir Henry Acland and Professor Westwood.—February 5th. The President in the chair. Mrs. F. H. Peters was elected to the office of secretary, most efficiently filled by Mr. H. M. J. Underhill since the foundation of the society. After the formal business, Mr. W. Warde Fowler, M.A., read a paper on "The Ornithology of Aristotle." He commenced with a brief sketch of Aristotle's life, saying that in his home and surroundings he had great opportunities for observing the habits and migration of birds. Although he lived long before the age of classification (2,000 years before Linnæus), he named and numbered 178 different birds out of 400, and so described them as to enable ornithologists of the present day to identify many of them; amongst which are our thrushes, blackbird, pigeon, cuckoo, kingfisher, woodpecker, wryneck, &c. Aristotle thought that some birds hibernated by retiring into caves and holes, and losing their feathers. He does not seem to have thought that all birds moulted, although he speaks of some changing their feathers. At the close of his paper, the lecturer described a swallow's nest built in a boathouse belonging to Mr. Vernon Harcourt, of Cowley Grange. The nest itself was of the usual kind, but it had a curious appendage in the shape of a terrace, constructed of the same material, extending along the whole length of a beam. A probable explanation of it was: some of the beams in the boathouse had been tarred, and the birds, fearing the one leading to their nest would be treated in the same way, proceeded to cover it themselves. Mr. Aplin exhibited a blackcap, which was shot at Bloxham during the late severe weather.—February 19th. Lecture by Professor Sydney H. Vines, D.Sc., F.R.S., on "The Plant and the Soil." The lecturer said he would briefly describe the way in which roots are distributed in the ground, and the way they lay hold of nourishment. The function of roots is to take up nourishment from the soil, which can only be absorbed in a liquid state. A certain portion of the soil is alive, *i.e.*, alive with germs: the top-soil is living, the sub-soil is dead; for this reason, in "trenching," the gardener always takes care to keep the top-soil on the surface. Germs reduce the organic matter in the soil, and fit it to be taken into the plant as nourishment. The decay of organic matter is due to the presence of bacteria. After explaining the action of "root-hairs" in taking up nourishment from the soil, the lecturer showed how some plants gained the same object in a very different way, *viz.*, by going into "partnership" (symbiosis) with certain fungoid growths. For example, the Leguminosæ (pea and bean tribe) have curious tubercles on their roots. These are full of a kind of fungoid "germ," which derive their nitrogen from the air present in the soil, and pass it on to the bean plants. Thus a crop of beans leaves the soil richer in nitrogenous compounds than it was before the crop was planted, and yet beans contain more nitrogen than any other plant. Something similar occurs in the roots of trees of the order Cupuliferæ, which, instead of root-hairs, have their ends covered with a thick felt of fungus mycelium, which acts as root-hairs do in other plants. This is a case of symbiosis only paralleled by lichens, in which plants, algæ and fungi, live together, forming what we call a "lichen." A discussion, followed by a vote of thanks to the lecturer, closed the meeting.

THE ARAN ISLANDS.*

BY PHILIP B. MASON, F.L.S., F.Z.S., ETC.

WITH ILLUSTRATIONS FROM PHOTOGRAPHS BY MESSRS. J. E. NOWERS
AND J. G. WELLS.

(Continued from page 52.)

This is a convenient place in which to attempt some description of the duns or forts. These are more or less circular in outline, and built up of loose stones, laid one on the other. The limestone of which they are constructed weathers and splits in more or less flattened slabs, which are easily piled up. The general plan is that of an inner enclosure with two outer concentric walls, the latter being protected by stone *chevaux de frise* covering a considerable extent of ground. No two of the duns are planned exactly in the same way, but the largest and most striking specimen is Dun Ængus or Dun Eanes (Plate I., fig. 1). Dun Eanes is built on the brow of the highest precipice in the island, 302 feet above the sea level, and the descent is so sheer, that the islanders are in the habit of fishing from its edge, with the aid of a short stick or rod, not much more than a yard in length. From its position on the edge of a cliff, there is no necessity for the completion of the circle of the wall, which is therefore built in the shape of a horse-shoe, the space enclosed by which is 150 feet in length by 142 feet in width. The circuit of the wall of the inner enclosure is the only one of the walls without any other opening than a doorway. The wall is 13 feet wide, and averages 18 feet in height; it is built up on the inner and outer faces of regularly shaped stones, the space between being filled with rubble (Plate I., fig. 2). On the inner side, are two stone platforms, reached by flights of stone steps. In this there were originally two doorways, one of which is now closed by the inner wall, while the open one has a width of 3 feet 4 inches at the top, and a little more at the bottom, the top being formed by large flagstones piled one above the other. In the breadth of the wall on the north-west side, there is a passage or chamber. In the enclosure are the remains of stone houses or cloghauns. The outer walls have openings left in them, but the openings in the middle and outer walls are placed at some considerable distance apart, and the whole protected by the sharp stones of the *chevaux de frise* (Plate II., fig. 3). The whole extent of the sea front between the outer walls is 1,150 feet.

Of these duns there are four in the large island, viz., Dun Ængus, which I have just described; Dun Oghill, which is placed about 400 feet above the sea level, and not far from the

highest point of the island (Plate II., fig. 4). Dun Oghill and Dun Onacht (Plate III., fig. 5) are in excellent preservation. The walls of the latter dun are 15 feet in thickness, and its longest diameter is 94 feet. Of the fourth dun, Doo Caher (Plate III., fig. 6), or the Black Fort, I have already made some mention when speaking of the first settlement of the Firbolgs, at a date which tradition places about 3,000 years ago. This structure is also placed on the edge of a beetling and lofty cliff, and to all appearance is considerably older than the others, the age of which cannot be much less than 2,000 years. While the stones of Dun Ængus, Dun Oghill, and Dun Onacht retain their colour and the sharpness of their edges, those of the Black Fort are much blackened, and give the impression of immense antiquity. There is a look of mystery about this structure, flanked as it is by the remains of an extensive settlement of stone houses, or Firbolgic city, in its decay, wanting in the other three, which almost look as if they had been built within living memory.

On the middle island there are two duns. One, Dun Connor (Plate IV., fig. 7), or Conchovar, is very large and perfect. Of the other I know nothing except that I saw it from the sea, as the weather never permitted me to land on this island.

On the southern island may be seen the remains of a dun, in the centre of which are the ruins of a mediæval fortress called Furmina Castle.

I have several times mentioned the cloghauns, or stone dwellings, the remains of which are scattered over the island. These are low stone structures of two kinds, the earlier ones being little more than sleeping places roofed by a flat stone, in which it is impossible to stand upright. Of the second, or beehive houses (Plate IV., fig. 8), there is still one perfect specimen to be seen by clambering over a succession of stone walls. This is a circular erection, with a roof constructed of circular layers of stone, laid with their edge projecting on their inner sides, and repeated until the space between them can be closed by a single stone. No doubt the roof was made weather-tight by placing sods of earth on the stones. The height of this is sufficient to allow of an upright position, but the only means of entrance is by creeping on the hands and knees. Near it is still to be seen a heap of broken shells, the contents of which have been used for food, a so-called kitchen midden. It is said that such houses were inhabited here until the commencement of this century.

At the present time these venerable relics of antiquity are in a comparatively good state of preservation; the great danger menacing them is that of rabbits. Rabbits are not very numerous in the islands, and the natives, when digging up their burrows, are apt to be regardless of other considera-

tions ; in fact, I saw in several places holes in the roadway quite six feet deep, which had been made in this way. It is a pity that the provisions of the Act for the Protection of Ancient Monuments have not been extended to Ireland.

Before approaching the epoch of the introduction of Christianity into Aran, I have still one other relic to notice, viz., the stump of a Round Tower, unfortunately now only a stump 4 or 5 feet high with a circumference of 45 feet round the base. Eighty-eight years ago Dr. Petrie was told by an old islander that it was formerly 82 feet high. These mysterious structures called Round Towers are peculiar to Ireland ; they are cylindrical in shape, from 60 to 90 feet in height, surmounted by a conical cap, and are destitute of any entrance into the interior. The time when they were erected is uncertain, but it was evidently long after the period of the duns, as they are built up of dressed blocks of masonry cemented together. Nothing is known with any certainty of the use to which they were devoted, although there are endless theories about them, but there is little doubt that they were connected with religious observances.

I now come to a period in the history of Aran possessing an interest of an entirely different kind, although still full of attraction for the archæologist. This period is that of the introduction of Christianity into the islands by St. Endeus in the 6th century. The name of this person is written indifferently Endeus or Enda in the old Latin Lives of the Saints, and is called Eaney or Eana in the spoken Erse. He belonged to the royal house of Oriel, a territory comprising the present counties of Louth, Armagh, and Monaghan, and was converted by his sister, St. Fanchea, a nun. He repaired for religious purposes to Italy, where he became the founder or head of a large monastery ; and, returning to Ireland after the lapse of many years with a numerous body of monks, obtained through the solicitation of St. Aible, the first bishop of Cashel, from Ængus, King of Munster, the Island of Aran, which had apparently passed from the Kingdom of Connaught to that of Munster since the time of Queen Maeve. He found it to be inhabited by a few Pagan Firbolgs, who fled in their curraghs without waiting to hear the word of God ; and he founded in Aran before his death, which took place about the year 542, no less than ten religious houses. Ara Mor thus became celebrated among all the anchorites of Western Europe. It was divided into two parishes ; over the eastern parish St. Endeus himself presided, while the western was under the jurisdiction of the most eminent of his disciples, St. Breccan, a son of the Prince of Thomond, and the founder of the old diocese of Ardbreccan in Meath. The names of others of these holy persons are preserved in connection with the

religious antiquities of Aran, as St. Benan or Benignus, St. Kronan, St. Caradoc, who was a Briton, St. McLongius, St. Eperninus, and others. St. Brendan of Clonfert, the celebrated navigator, visited Aran in the course of his famous Atlantic voyage, and started thence on his supposed trip of discovery to America.

In fact, Aran became a great school of asceticism and sanctity, and was constantly resorted to from the Continent to study the sacred Scriptures, and to practise the austerities of a hermit's life. An ancient writer states that "in one small cemetery here the bodies of 120 saints repose," and more saints are buried in Aran than are known to anyone but God alone; in fact, that relics as sacred as those which Catholics travel abroad to venerate in other countries here lie neglected under moss and bramble on our own deserted shores.

About 1645, when Colgan was editing a history of the life of St. Endeus for the "*Acta Sanctorum Hiberniæ*," he obtained a MS. compiled by Augustin Magraidan from an authority which seems to be as old as the days of Paganism. This gives a list of the principal churches in these islands, of which there were three in Inisheer, two in Inismaan, and thirteen in Ara Mor; leaving it to be inferred that there were others of lesser note.

No doubt many of these ecclesiastical buildings had fallen into decay before the time of Cromwell, but the work of destruction was completed by his soldiery in the demolition of the great monastery of St. Eany, the stones of which were used to strengthen Arkin Castle, a ruin of which I shall speak later on. The present provision for the religious necessities of the inhabitants are two churches of the most commonplace character, one Roman Catholic and the other Protestant. Of the latter there are not more than thirty or forty in the three islands, and they are chiefly coastguardmen and their families. However, the religious antiquities which have until now escaped the effacing fingers of time and the ravages of man are of the greatest interest. They consist of bullauns, or baptismal stones; *open air altars*, like that of St. Eany; holy wells, like St. Eany's, which never dries and which never contains more than 4 or 5 inches of water. It is still the custom to put small offerings in these wells. I saw various objects so placed in the Holy Well near the Church of the Four Beautiful Saints. There is no doubt that many of these open air relics were formerly objects of reverence in Pagan days, and that in progress of time this reverence has become invested with Christian associations. The other remains are those of monasteries and churches.

(To be continued.)



Fig. 1.

DUN ÆNGUS.



HERALD PRESS, LITH. BIRMINGHAM

Fig. 2

DUN ÆNGUS
INNER SIDE OF WALL AND DOOR.



Fig. 3.

DUN AENGUS. CHEVAUX DE FRISE.



Fig. 4.

DUN OGHILL.

PLATE III.



Fig. 5.

DUN ONACHT.



HERALD PRESS LITH BIRMINGHAM

Fig. 6.

DOO CAHER.

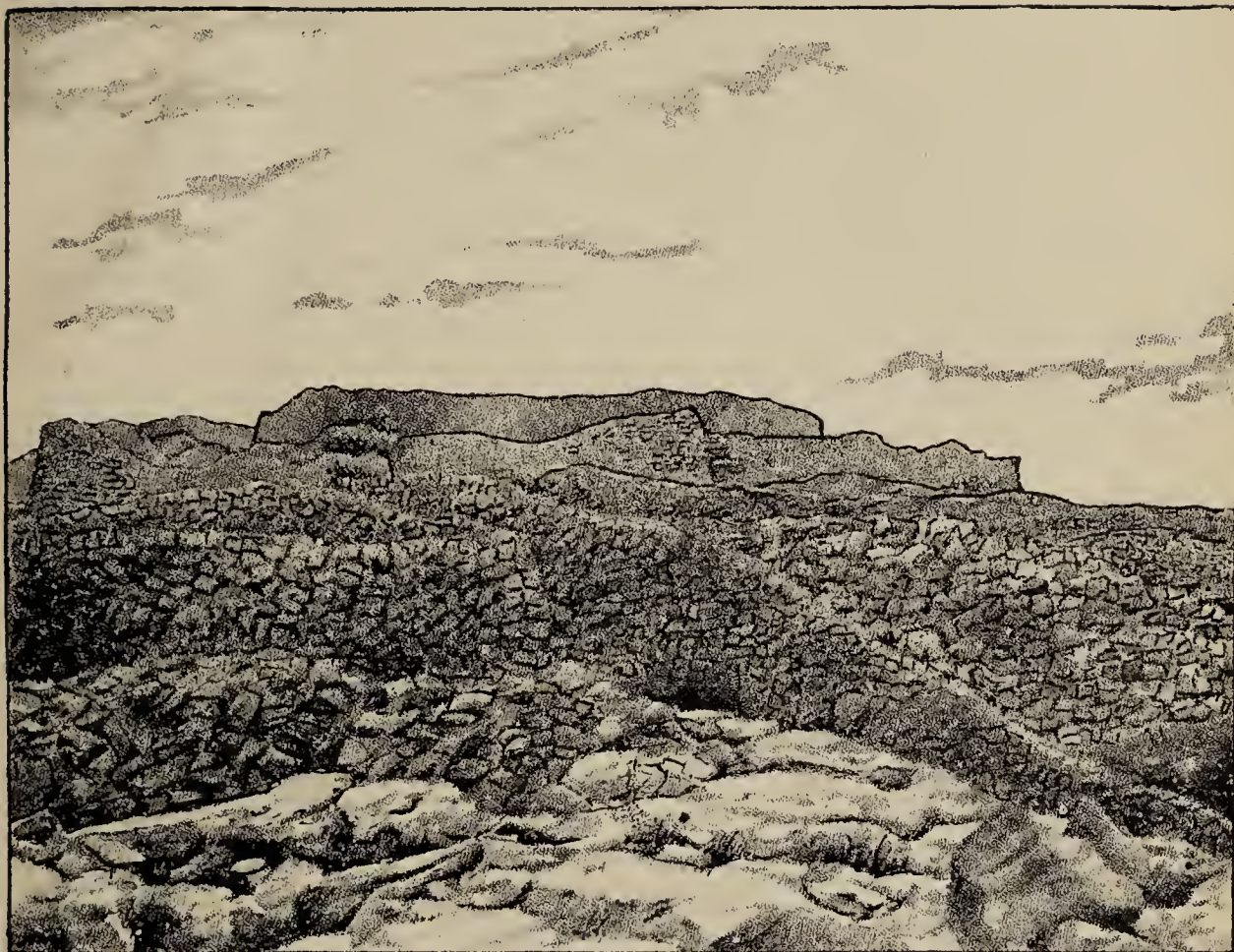


Fig. 7.

DUN CONNOR.



Fig. 8.

CLOGHAUN NA CARRIGA,
OR STONE HOUSE OF THE ROCK.

PERSONAL OBSERVATIONS OF GLACIAL ACTION AMONG BRITISH MOUNTAINS.*

BY HORACE PEARCE, F.G.S., F.L.S. (RECENTLY PRESIDENT OF THE
DUDLEY AND MIDLAND GEOLOGICAL SOCIETY).

In bringing before the members of the Birmingham Natural History Society a few evidences of glacial action, observed during brief holidays chiefly in Wales and among the mountains of our beautiful English Lake District, I do so with the object of pointing out some special instances of marked character which arrested my attention, in several cases quite unexpectedly, and in remote glens or wild ravines not so often visited by the general public. And I wish more particularly to dwell upon evidence of distinct ice action rather than now to enter upon the vexed question of *causes*, or to endeavour to distinguish between any assumed general ice-cap extending far down this northern hemisphere, and the local glaciation more confined to the mountain districts. I should like to convey something of the strong and repeated indications of the local action of small glaciers on most of our highest mountains; a condition which, though geologically quite recent, is yet very remote from the present day if measured by number of years, could this be done; for we are met here, as elsewhere in geology, by the demand of unlimited time.

And here I would remark that these distinct and striking phenomena are the more remarkable, considering how comparatively slight is the altitude of the highest mountains in the British Isles. At the same time, we must bear in mind that they are in most cases, perhaps in all, greatly reduced from their original height; as we feel when standing on the apex of Snowdon, supported now by ridges that enclose great and profound hollows, or *cwm*s, in the old Welsh language, and realise how, noble as it is, this is but a fragment of the original mountain, though yet so wild, serrated, and grand.

But to proceed directly to a few traces of the paths of the old glaciers. A few years ago, when spending a short holiday at Mardale, that little lonely pastoral glen above the head of beautiful Hawes Water, in Westmoreland, I spent some time round the shores of Blea Water, one of the wildest tarns I ever saw, of notable features in crag and precipice, surrounded closely on three sides by the rugged rocks of High

* Read before the Birmingham Natural History and Microscopical Society, April 15th, 1890.

Street Mountain. In some positions, and under some lights, its waters are black, and seem very deep; an impression still further conveyed by the steepness of rocks plunging in on two sides. But across its outlet is a barrier that looks almost artificial, nearly as much so as a railway embankment, and is a great contrast to most of the bare rock surfaces around. The waters are evidently chiefly confined by it, and although we cannot say at what depth in it we might come to the solid rock, it is mainly composed of smaller portions of rocky material, and I have no doubt is a large moraine left by the ice in its later stages. The whole of this recess under High Street and Harter Fell has a singularly worn look—a sort of carved-out appearance—and forms a remarkably bold bit of scenery. On its northern side runs a ridge, about east and west, for nearly a mile-and-three-quarters, uncommonly rough and narrow in places, called truly enough Rough Crag, as I found one morning when I scrambled along it part way, and found it to sink profoundly and at a steep angle into this hollow enclosing Blea Water, and on the opposite side into the scarcely less wild and secluded Glen of Riggindale. I mention this, because when you traverse the skyline of High Street you see how *some* agency in the past, which I feel sure was ice principally, has very nearly cut right through the mountain. But down below, where the end of this Rough Crag curves slightly, and where, on this supposition, there would be a great pressure from the curving glacier, you come upon a long, even, sloping surface of rock, as though planed off in a most remarkably smooth and even manner, which, to my mind, corresponds closely with what one can see would be the result under such conditions. This smooth, planed surface of its lower slope, where the valley trends towards Hawes Water, forms a telling contrast to the broken, irregular rocks along the ridge, and to the wild heights about lonely Blea Water.

In walking across one afternoon from Mardale to Patterdale, after passing over Kidsty Pike and High Street, before proceeding into the lower valleys, I turned aside to notice a small lake resting under long green hillsides—remote pastoral Hayes Water. At an elevation of 1,383ft. above the sea, and with only shepherds' paths near it, the half-mile length of pure water has a very clean untouched appearance. But what drew my attention most was a number of little mounds, almost bee-hive shaped, near the upper end of the lake, having almost an artificial appearance, distinct one from another, and quite unlike the ordinary slopes of *detritus* below the rocks. Evidently, to my mind, they are glacial moraines,

shed from the end of a small and slowly retreating glacier that once filled this deep glen, striking back into the heart of the High Street range; undisturbed and most significant, seen at once to have been caused by no ordinary action of the weather. Here I would remark that such small terminal moraines would probably be numerous, as they are in this instance, because, during the amelioration of the climate, it is likely the glaciers would alternately retire and advance, probably during a long period, before finally leaving the valleys. In such cases frequently we do not readily find any scratched stones in the material, because of the short distance it has travelled.

Not far from this spot, and just where two long valleys, coming down on either side the bold height of Red Screes, meet above the little, but interesting, lake of Brothers' Water, I found and counted fifteen or sixteen distinct moraine masses where the ice would converge near the site of the present lake. These numbers are from notes taken at the time, when I was much impressed by the striking assemblage of these relics of a bygone geological period.

Directly north of Ambleside and Rydal rises a bold mass of mountain ground, culminating in the lofty Fairfield, so well known to Wordsworth and his charming sister Dorothy, during their residence in these villages. From Fairfield two long spurs come down closely to the shores of Rydal Water, one of these ending suddenly in the fine cliff called Nab Scar, often admired on passing along the coach road just below. Instead of running down and ending gradually, like the other spurs of the same group, this one is cut across, causing the bold precipitous cliff just mentioned. Now a glacier filling the Vale of Grasmere, and coming down from the wild hollows above, would meet with a narrow passage just at this place; and I have no doubt this was the original agency in planing off the lower end of this spur, as the ice ground its course out in proceeding down towards Windermere. I am not aware if the probability of this has been pointed out before, but would like any one travelling that way to observe this Nab Scar in relation to its own and the other spurs coming down from the more central mass of Fairfield. Seen from below, it rather astonishes people, new to that glorious region, to point out that this is merely the end of a long mountain ridge reaching back some three-and-a-half miles.

I remember once, after a grand ramble among the mountains just alluded to, and others about Brothers' Water, I was returning on the western side of the lake and admiring the golden sunshine flooding with light all the opposite side of the

valley, when presently crossing the outlet of Dove Dale Glen my attention was suddenly taken by a block of rock lying detached in a wide green pasture. So off I turned towards it, but evidently the dogs of the district had concluded that none but shepherds should pass unchallenged, or instinctively divined I was no "gude Dalesman," for they set up such a roar, five of them, that I felt glad of a good ferrule on my long staff. However, they drew off after a while, and I walked up to the block, to my mind undoubtedly brought down out of the glen by a glacier, because on looking all round and observing the nature of the country, it seemed impossible any other known motive power could have carried and landed it so far from its parent cliffs. I measured it, and found it approximately 10ft. 8in. by 8ft. 10in. by 7ft. 9in., a nice little waistcoat-pocket specimen!

Passing now to another part of the Lake District, this time in wild, rocky Cumberland, I would call attention to the very strikingly glaciated appearance of the rocks at what may be termed the jaws of Borrowdale, that well-known vale reaching up into the heart of the mountains; one of the finest bits of scenery in the British Isles. Far up above, a number of wild glens come down from some of the loftiest heights in England, and unite just above the village of Rosthwaite, where a wide level strath indicates the site of a former lake not so long ago. At the northern end of this beautiful opening the vale narrows suddenly, and rocks converge closely to dispute the passage of the picturesque Derwent. Now if glaciers formerly came out of these rocky recesses up above, and united as they must have done just above Rosthwaite, what would be the result? Evidently a constricted passage here, and great pressure. Accordingly we find almost every surface of rock most remarkably smoothened and planed over, all roughness *originally* taken off in the direction facing up the Dale, but a few broken surfaces remaining on the northern side of the rocks, just where masses of ice passing over might leave them with less pressure, as the rocks broke down more or less towards the north. Many a time I have left the roads and got on the smoothened rock surfaces to note their wavy curving contours, seen here and there to pass under slight covering of peat or heather, or to gather some of the rarer wild plants abounding there, where vegetation has covered the surface. In few spots that I have studied have I found the glacial indications more distinct over wide spaces of rock than there. They may also be examined again at Grange Bridges just beyond, close to the bed of the swift and beautiful Derwent.

Passing again over another interval of mountain ground, and proceeding more towards the west, there is a mountain called Robinson, curiously enough, which breaks down in some precipices towards the north and west, below which, and partly surrounded by them, lies the head of one of the many rugged glens or ravines of the district. And here again one day, when walking over from Buttermere, I noticed a number of small moraine masses, very distinct looking, untouched for the greater part, or in one or two places cut through by the action of the present stream. These again gave me the impression of having been shed from the end of small and retreating glaciers that once to a great extent covered the mountains of our island, if indeed the land was not enswathed by them, as Greenland is at the present day.

Before leaving this most lovely district there is one other spot I wish briefly to allude to—the wild and romantic Deepdale, which possibly some of you may have visited: a glen exhibiting singularly bold features, where you see the carving-out of these ancient rocks on a grand scale. Nature seems to have left her handiwork lying about in more primitive fashion than usual. It lies mainly enclosed by the mountains of Fairfield and St. Sunday Crag, and one lovely day I descended into it from this latter height; one of those “Heavenly days that cannot die,” memorable for a lifetime. I got down carefully, for the slopes are very steep, after prospecting in two or three directions! But below—how grand the scene! Wild precipices enclose the head of the glen, whence vast masses of rock are seen to be torn out by some old power; and far down the glen, where it becomes a valley, I was much attracted by several great moraine masses cut through here and there by the stream, and very emphatic, while several great blocks of enormous size are left here and there far down and distant from the rocks whence they must have been brought, and placed in some cases on knolls in the valley, a long way from the sides, so that I felt sure they could not have fallen from any rocks by ordinary action of the weather; and for my part can recognise no agency but ice that can be assigned to have left them there. This Deepdale is wonderfully grand in all its details, and I can strongly recommend its study to the geologist and lover of wild, natural scenery.

Turning now to North Wales, I would like to call attention for a moment to the neighbourhood of Ffestiniog, where the slate and other mountains have a remarkably bold form, and where indications of glacial action are well marked. On one occasion I was very much interested with the strikingly smoothened and rounded surfaces of the rocks of rugged Moel Wyn, at the entrance to the long narrow glen of Cwm Orthin, where this action was seen extending far up the

slopes of the mountain, with here and there large grooves running along in the direction the ice must have taken in being forced by its weight above, through this narrow passage, and poured into the valley below. The features at this spot are most clear, and the height considerable to which you may see the ice must have reached.

In the glen just above now extends the narrow but deep rock-bound lake of Llyn Orthin. After noting these indications, I was pleased one day to find below, in the more open valley to which Cwm Orthin leads, a well-marked striated rock specimen, which I have brought and placed on the table with a few other glaciated stones. I found it near the site of the present railway station of Blaenau Ffestiniog, at a depth of several feet, where channels had then been recently cut deep into the previously undisturbed bed of the valley, and below a thin layer of peat.

Again, when once spending a short holiday at Llanbedr, I found clear and very telling phenomena of the agency of glaciers up in the higher portion of the valley of the little River Artro, near to the rugged and wild mountains on each side the ancient Pass of Drws Ardudwy. There I found one particularly interesting large rock surface, bare of vegetation for a considerable space, and wearing still an aspect of surface planed off, largely smoothened and grooved. Down below this, not far away, where the valley is wide and flat, I noticed many blocks that seem impossible to have been carried where they are by any other action but ice, which has (it seems to me) let down one unusually large mass on to a bare surface of rock. In searching below among small stones I met with some distinctly striated, although apparently they could not have travelled far.

Once in walking down the narrow Pass of Drws-y-Coed, not far from Snowdon, a wild spot, I was fortunate to come across a surface of the original rock (if one may use such a term), just then recently laid bare in widening the road. It was beautifully planed over and striated in a direction down the Pass.

One sunny day of a knapsack holiday I came across a large block of rock in the bed of the rapid and picturesque Wye, near Newbridge, when walking in the bed of the stream where it flows wide and shallow over rocks, the water being then very low. It had the same appearance of rounded surfaces and striations on some parts, and I felt no doubt it had been brought out of some far recess of the mountains. It looked too large to have been rolled far by the river. And here I would remark that this effect of ice action in smoothening rock surfaces causes them to be afterwards less rapidly degraded by ordinary weather action, as leaving fewer projections and angles for rain, frost, or sun to act upon.

Once at Aberdaron, in the south-west corner of Caernarvonshire, near to the sea shore, I found several finely-striated stones, which I have brought, as the lines are very well shown. The nearest heights are the Rival Mountains, only a few miles distant, and about 1,800ft. of elevation above sea level, but these specimens probably came from a greater distance. Although rather outside the scope of this paper, I have brought a specimen of dark carboniferous limestone, which I got out of the railway cutting at Whitby, on the Whitby and Redcar line. It was at a great depth below the surface in the cutting, and probably came from one of the mountains of limestone in the west of Yorkshire. And I remember, at Sedbergh, seeing similar black or very dark limestone worked into steps and monuments in the church. Anyhow this specimen must have travelled a long distance, and I have placed it on the table because it is a thoroughly characteristic one, having the many fine lines beautifully shown, and also the generally soft smoothened outlines, even until it has become partly polished.

In this slight sketch of the subject, I have purposely dwelt upon indications of the ice action, which I have myself observed in some of the less frequented spots, sometimes come across quite unexpectedly, when wandering among the recesses of the hills for health and scenery. Therefore, I have omitted reference to the wild recess of Llyn Idwal, where the clear glacial phenomena were, I believe, first observed by the great Charles Darwin; also the ice-shaped and now very picturesque Pass of Aberglaslyn, to which attention was called long ago by Buckland, the celebrated geologist; and for the same reason have refrained from dwelling upon the grand Pass of Llanberis, and more especially the striking features of Cwm Glas, just below the peak of Snowdon, because these have been forcibly illustrated and described by Sir Andrew Ramsay; but have endeavoured to confine myself strictly to some of my own personal observations, which have convinced me of the once extensive glaciation of our British mountains.

THROUGH NORWAY WITH THE VESEY CLUB.

(Continued from Vol. XIII., p. 274.)

It will doubtless be remembered that the St. Rognvald, upon whose decks the conjoint Vesey Club party had now assembled (July 13), had sailed from Leith on Wednesday, July 9, and had called *en route* at Bergen and Molde, arriving at Trondhjem on the morning of the day upon which we

joined her. She brought with her a party numbering nearly fifty, including amongst them no less eminent an individual than the President of the Club (Sir Robert Ball, F.R.S.), who, with Lady and Miss Ball, had joined at Leith. The further members of this section were:—Mr. S. H. Baker (the well-known and genial Secretary of the Royal Society of Artists), Mr. S. J. Barnes, Mrs. and Miss Barber (Edgbaston), Mr. and Mrs. Jos. Bullows (Sutton Coldfield), Mr. Cecil Crosskey, Councillor T. S. Fallows, J.P. (Edgbaston), Mr. and Mrs. C. J. Gilbert (Berkhamsted, formerly of Sutton Coldfield), Alderman Glover, J.P. (Sutton Coldfield), Mrs. Hamilton (Melton Mowbray), Mr. and Mrs. G. H. Haswell (Handsworth), Mr. H. Hobson (Sutton Coldfield), Mr. C. Hodgkinson, Mr. and Mrs. A. G. Hooper (Dudley), Mr. and Mrs. James King (Tyseley), Rev. T. S. Lea, M.A. (Tedstone Delamere), Mrs. and Miss Madeley (Erdington), Mr. and Mrs. Robt. Mann (Handsworth), Mr. H. J. Palmer (Editor, *Birmingham Daily Gazette*), Mr. and Mrs. Henry and Miss Payton (Edgbaston), Mr. and Mrs. W. Pumphrey (Bath), Mr. H. B. Rathborne (Dublin), Mr. W. Ray, F.C.S. (Kidderminster), Mr. Walter and Miss Roberts (Edgbaston), Mr. Hy. Sturmeay (Coventry, Editor of the *Journal of Photography*), Mrs. Richard, Miss, Miss Elsie, and Mr. A. L. Tangye (Gilbertstone), and Mr. and Mrs. F. J. Walker. In the passage out this large contingent had found the vessel none too big for their purposes, and I am somewhat afraid that from their point of view the overland section were of the nature of intruders. We on our part shed bitter tears for them, but proceeded nevertheless to promptly oust them, or their luggage, from our own berths, a process to which, be it remembered to their credit, they submitted with most exemplary patience. It was a fine case of submission to the moral law, for they outnumbered us by nearly two to one. Possibly, however, they recognised that we were in better “condition” than they; anyway the peace was not broken. To mollify them, and at the same time to promote the fusion into a whole by dropping the distinctive titles of “overland party” and “sea party,” which it was constantly necessary to use, the testimonial-writer to the expedition dubbed the former the “overlanders” and the latter the “overseers.”

We spent the next day at Trondhjem, some being attracted by the cathedral, some by the big waterfall, the Liefos, a few miles off, some by the remarkable lines of ancient raised beaches along the river valley. To Englishmen the cathedral is perhaps the most interesting, a building of many ages and many styles, but the earlier part of which (13th century) was constructed by English architects, and strongly suggests more

than one of the English cathedrals of the ornate Gothic type. Most attractive, however, are the internal decorations, lavishly cut in a slate-coloured soapstone, soft to work when fresh, but retaining all the delicacy of its finish well on into a ripe old age.

We wound up our stay at Trondhjem by a dinner, to which were invited various local notables—consuls, professors, and the like. The menu was rather English, but described in old Norse. As few readers of the “Midland Naturalist” will have set eyes upon a real Norwegian menu, here it is:—

MATARSEDILL.

Mánadaginn þann fjórtánda Júlý 1890.

Kjötsúpa með grænmeti.

Lax, nidrlenzk sósa.

Uxa-hryggur með sveppum.

Kálfamjólk með valhnotum.

Kjúklingar.

Berjasulta, salat.

Rjómahræringur að síð sendiherra.

Ís með rjómahræringi ásamt nýjum hnotum.

Tvibökur, smjör, ostr.

Á gistingastað „Nordkap.”

í

Nidarósi.*

After dinner a considerable number of our guests and many townsfolk accompanied us to the steamer and cheered our departure, which took place in the bright gloaming just before midnight.

Our plan for the next day was a drive through the famous Romsdal and back. The Romsdal commences at Veblungsnaes, at the head of one of the branches of the Molde Fjord, and the terminus of one of the great roads which, as I have already said, join on to the Dovre road at Domaas. It is chiefly remarkable for the extraordinary jaggedness of its cliffs and peaks. Norwegian mountain scenery is, as a rule, somewhat tame; the summits very rarely take the form of sharp peaks, but in the Romsdalshorn (5,000ft.) we have a veritable aiguille of Matterhorn-like steepness, which for hours we had seen dominating the view as we ascended the windings of the fjord. The cliffs and peaks on the southern side of the valley, commonly known as the Trolltinder (Goblin Peaks), are serrated in the most remarkable fashion; and in the middle of the valley boils and tumbles the usual Norwegian stream, the water of which is here, however, of the

* Nidarosi is the old Norse name of Trondhjem.

most marvellous blue-green colour. Crowning the line of cliffs is a great snowfield, from which in spring fall numerous avalanches, huge relics of which are still visible as we drive along. A few miles up the valley, just opposite to the entrance of another branch from the south, stands the house of an English resident, Mr. H. O. Wills, one of the well-known firm of tobacco manufacturers, who, like his more famous namesake, Sir Alfred Wills, is passionately fond of snow-clad mountain and glacier stream. The so-called ice cave, at Horgheim, which is the summit of our drive, is in reality an arch cut by water through the remains of an avalanche under a bit of lofty cliff, from which the snow-slips never fail to come. The arch itself is hardly worth the climb to it, but the views out of it and across the valley are delightful, and the bilberries most luscious.

As this was our first excursion as a united party, it will be well here to explain our aims and methods. The west coast of Norway, like that of Scotland and of Ireland, is pierced by a number of long narrow inlets, known as fjords, the largest of which, Sogne Fjord, is more than 110 English miles long. These fjords are all narrow, varying from five or more miles wide at the outlet, to only a few hundred yards at their upper ends, where also they are repeatedly branched. Their shores, or banks, relatively low and water-worn at their mouths, get more and more lofty and precipitous as we go further inland, till ultimately, in the finest of them, such as the Geiranger Fjord, or the Naero Fjord, they are enclosed by vertical cliffs from three to four thousand feet in height, between which the direct rays of the sun, in some cases, never fall. It is amongst these upper arms of the Norwegian fjords that the finest scenery in Northern Europe is to be found; and, though to the geologist or the botanist some of the inland fjelds are of surpassing interest, to the sightseer these fjords offer attractions compared with which everything else picturesque which the whole of Scandinavia contains is but as "sounding brass and tinkling cymbal." To the lover of Nature in her grander moods, to one whose ideal of beauty involves four elements, cliff, sky, snow, and water, I can do no more than strongly recommend that they should spend their whole time on the western fjords. They may, possibly, have from time to time too much of the last of the four elements in question, but betwixt Odde on the Sör Fjord, a branch of the great Hardanger, on the south, and Veblungsnaes, on the north, they can have a surfeit of them all in the most perfect conceivable combinations.

Our present object, then, was to see some of the finest of the upper arms of these fjords, and of the valleys leading

into them. For this purpose our steamer was rather a convenience than a necessity, since we could use it or leave it at our pleasure; *i.e.*, it could deposit us at any particular place, and, as in this Romsdal expedition, could await our return to the same place; or, on the other hand, could move on to some further point, at which we could be picked up. The heads of some of the upper branches of Norwegian fjords are occasionally separated from one another by but a few dozen miles of land, while passing round by water might involve a journey of perhaps as many hundreds. On two occasions we were thus deposited by our steamer at the head of one fjord, and, while we made our way across by land to the head of another, our steamer went round by water and met us. Our next expedition illustrated this. Resuming our steamer at Veblungsnaes, while we dined and slept we were carried round a hundred miles or so to Meraak, at the head of the famous Geiranger, a branch of the Stor Fjord. This Geiranger Fjord is one of the culminating glories of the west coast of Norway. The water is a mere wandering streak, generally about a quarter of a mile in width, but bounded by the most magnificent cliffs it is possible to imagine, averaging little short of 4,000 feet in height, and generally a sheer vertical for half that amount. We were roused long before six a.m., so as to miss nothing of this fjord—a grey cheerless morning, with a persevering drizzle, the acquaintance of which we were destined to make at greater length later in the day. I think I have already referred to the weather which accompanied our Norwegian tour, and which gave us but three rainless days during our entire absence from Birmingham. Well, as almost every misfortune possesses some compensating advantage, so with these nearly incessant rains. Next to her fjords and cliffs, nay, rather far ahead of them, Norway is, *par excellence*, the land of waterfalls. Hardly a day passed without our seeing a fall, the merest fraction of which would make the immediate fortune of any west or central European holiday resort; and sometimes not one, but a half dozen. Of such a nature is this Geiranger Fjord, for from its stupendous cliffs hang waterfalls by the dozen, varying from this whose loud thunder can be heard long before it itself comes into sight, to that whose thin filmy veil becomes more and more diaphanous in its two thousand feet of descent, until it literally disappears in middle air. Noticeable amongst a middle type are the so-called “Seven Sisters Waterfalls,” the seven being, however, but a figure of speech, for, with the best will in the world, and unlimited materials in the way of rain, we could count but five. Above Meraak is a remarkable level plateau,

which, as seen from the steamer, looked much like a former beach, but which, as like as not, is the terminal moraine of the huge glaciers which once came down these deeply-scored valleys.

Shortly before midday we landed at Hellesylt, whence we purposed to drive over the dividing ridge to Faleide, on the Nord Fjord, a matter of about thirty miles, while our steamer, with those who shirked the land journey, went round some 150 miles or so by water. Stopping for dinner at Grodaas (seventeen miles), we arrived at Faleide at about 9 O. I say *we* arrived. I ought rather to say what were left of us, for, while a score or more shirked the journey from the outset, more than a dozen others gave it up at Grodaas; so that, although we had a grand glacier expedition in view for the next day, we reached our journey's end little more than thirty strong. It is fair to say that nearly half of these were ladies. But Faleide was no resting place for us. The Kaiser, who at Christiania had already ousted our party from one hotel, had secured the only hotel at Faleide for himself and his suite for a fishing expedition which he had in view; and, though he was on his yacht, lying up the fjord at Olden, whither we were bound, they dared not, or said they dared not, give us admission to the hotel. But for this it is more than doubtful whether the rest of us would not have broken down here, and sent the glacier expedition to—Jericho. As it was, however, there was no help for us. Our boats lay at the landing stage, and we rowed nearly ten miles up the fjord to Olden, arriving there shortly after eleven—a tolerably hard day's work with such perverse weather—but receiving the warmest possible welcome at Yri's hotel.

In dealing with such a large party as ours normally was, it will be easily seen that a great many arrangements had to be made, and these arrangements had, if possible, to be carried out independently of the weather. This is a great and undoubted disadvantage attaching to a large party. Many of our present arrangements were made a month or more ahead, for it was a matter of no small responsibility to get together conveyances to move a possible seventy people over routes the regular travelling accommodation for which might not be more than a dozen. In making the necessary arrangements for this western part of our route, Mr. Stone had the invaluable assistance of Mr. Lamb, chief engineer to the North of Scotland Steamship Company (the owners of our ship the *St. Rognvald*). This gentleman met us at Trondhjem, and accompanied us nearly to the conclusion of our trip, and the whole of the detailed arrangements of this part of our journey

were made by him with the same wisdom and forethought which had been expended by Mr. Stone upon the route of the "overlanders." Horses and vehicles, for instance, had to be collected to time from all over the country side, sometimes from places a good day's journey from where they were needed, and hence our cavalcade showed a procession of survivals in the matter of vehicles such as probably have rarely come together in Norway. Most "rare and curious," to use the collector's term, of all were the saddles which were unearthed for an expedition which we made a week later on, and which was only possible upon horseback. If I remember rightly, one of the ladies' saddles then produced bore the date 1740. The ordinary lady's saddle used in rural Norway is rather an oddity in its way—somewhat like the seat and back of a library chair strapped on the horse's back. The uprights which support the back are apt to get weak with age, and, as the rider relies entirely upon their firmness, accidents are by no means infrequent. But gentlemen had to put up with an even wider range in the matter of saddles. Not a few of us had to be satisfied with a few sacks or rugs strapped on the horse's back, with or without a cushion laid thereon, in some cases quite stirrupless, but in others with what was even worse, viz., a doubled rope slung over the horse's shoulders, into each end of which a foot was to be placed. This is very well so long as the pressure of the two feet is uniform; but if the pressure upon one is greater, down it goes and up comes its fellow. Hence in any sudden lateral movement or turn of the horse the stirrups were an actual source of danger, and happy was the man who had learned by experience to hold on by his knees.

From Olden we, that is "the faithfuls," made a most delightful and interesting excursion to the Brigsdals glacier, one of the ice aprons which come down from the great Jostedal snowfield. Our way thither is partly driving, partly rowing, partly walking. The water portion is over a long, narrow lake, pinched in between huge mountains towering 5,000 feet or more above its waters, and with snow curtains descending here and there down gulleys in their upper flanks. Away beyond the head of the lake is for miles visible the beautiful Melkevolds glacier, while two hours' walk up a valley at right angles to the left is the glacier we are in search of. All the way up this valley the smooth, humpy rocks and frequent boggy pools betoken the path of an old glacier, so that, although the glacier is at present apparently advancing, it has probably within comparatively very recent times been far lower than it now is. The lowest end of this glacier is probably about 1,000

feet above sea level. It is cleft and split in a striking fashion, its caverns and crevices with walls of the most glorious and translucent blue. A hunt in these crevices for scratched stones yielded no results.

Though the icefields (fonds) of Norway are so huge, the glaciers (braes) all are small—insignificant, indeed, from the point of view of comparison with those met with in Switzerland. This glacier is one of the finest. I do not know the rate at which it is advancing, but its present end is thrust straight into the midst of a dense wood of birch and alder trees. When I visited the Buar Brae, a glacier from the Folgefond, probably the next largest icefield in Norway, in 1874, it was advancing down the valley at a rate of at least 50 feet per year, and 70 yards was given as its advance in one year shortly before that. The result, of course, is that the glacier has largely overridden its moraines, and these are barely recognisable. Here at the Brigsdalsbrae the terminal moraine is represented by huge mounds of loose, small, rounded, water-worn stones, amidst which the glacier streams make their way; while just below are huge ledges of bare rock, stretching right across the path of the glacier. A visit to the latter will be specially interesting when it has reached these ridges, unless, indeed, it pushes before it a sufficient mass of the loose pebbles to mask the huge rock steps. Being so small, the present Norwegian glaciers appear to be deficient in eroding power, though signs are everywhere abundant of the mighty sculpturing force they were in earlier ages. Our stay at this glacier was all too short; we had intended to lunch at it, but the uncertainty of the weather rendered this risky, so we made our way back to the houses at the head of the lake aforementioned, and lunched under cover. I fear that the appliances of civilization ran short; at any rate, a flash picture of the room would have revealed our guide, counsellor, and friend, Mr. Stone, doling out the delicious pancakes for which Norwegian cookery is famous with his fingers! And not one of us thought it in the least degree objectionable. How merely skin deep our civilization is!

(To be concluded next month.)

HISTORY OF THE COUNTY BOTANY OF WORCESTER.

BY WM. MATHEWS, M.A.

(Continued from page 41.)

The Brambles are treated of in the Appendix at the end of the table, pp. 37-48. The latest synopsis of the British Species is that contained in the 8th edition of the "London Catalogue," 1886. It is the work of Professor Babington,

and is explained by him in two papers in the "Journal of Botany," July and August, 1886, Vol. XXIV., pp. 216-223, and pp. 225-237. The nomenclature is almost revolutionised. I have done my best to correlate Mr. Lees's Rubi with the names of modern date, an almost impossible task, in which I have been kindly assisted by my friend, Mr. Bagnall. There are many notes in the "Journal of Botany," from which much information may be obtained. Among these may be particularly mentioned two papers by Dr. W. O. Focke, in the numbers for April and May, 1890, Vol. XXVIII., pp. 97-103; and pp. 129-135.

- * *Rubus Idæus*, L. 48. Throughout the county.
- * *R. suberectus*, Anders. 47.
R. fissus, Lindl. Mentioned as a var. of *suberectus* only. 47.
- * *R. plicatus*, W. and N. 47.
- * *R. affinis*, W. and N. 47.
[R. nitidus, W. and N., and var. R. hamulosus, L. and M., not recorded, but certain to be in Worcester.]
- * *R. rhamnifolius*, W. and N.
- * *R. Lindleianus*, Lees. 46. See Lees, Phyt., iii., 361. Bab. Br. Rubi, p. 75.
- * *R. incurvatus*, Bab. 47. Between Cowleigh Park and Worcester.
R. thyrsoides, Wimm. 46. Now known as *R. pubescens*, W. and N. See Bab., J. of B., Vol. XXIV., p. 220.
- * *R. discolor*, W. and N. 46. This familiar bramble must now be known as *R. rusticanus*, Merc. See Bab. ante. *R. discolor*, W. and N., is another form of *Rubus*.
- *† *R. argenteus*, W. and N. 46. Not British. Br. Rubi, pp. 108, 114.
- * *R. leucostachys*, Sm., 44, and var. *vestitus*. The latter is now var. *conspicuus*, P. J. Müll.
- † *R. Grabowskii*, Weihe. 44. Mentioned by Mr. Lees as a var. of *leucostachys*. Now *R. montanus*, Wirtg.?
R. calvatus, Bloxam, *R. Salteri* var. *calvatus*, Bab. 44, 45. First record.
- * *R. carpinifolius*, W. and N. 45. This name has been given to many forms of *Rubus*, and it is not certain that the plant so named by Mr. Lees is the *R. carpinifolius* of W. and N. It is probable that Mr. Lees's plant is *R. Maasii*, Focke.
- * *R. villicaulis*, W. and N. 44.
R. pampinosus, Lees, 44, is a form of the above. See Bab. Brit. Rubi, p. 141.
- ‡ *R. macrophyllus*, Weihe, 45 (Hereford).
- * Var. *amplificatus*, Lees.
R. mucronulatus, Boreau. 42. First record. This must now be called *R. mucronatus*, Blox.

- * *R. Sprengelii*, Weihe, 45, Br. Lickey, and var. *Borreri*, Bell Salter.
- R. Bloxamii*, Lees. 42, Wyre Forest. *First record.*
- * *R. pallidus*, W. and N. 42. *The plant so named by Mr. Lees appears to be R. rosaceus or R. Hystrix, of Weihe.*
- * *R. scaber*, W. and N., 43, and var. *verrucosus*, Lees. Br. Lickey. *The latter is R. Babingtonii, Salter.*
- * *R. rudis*, Weihe. (*R. echinatus*, Lindl. *Lond. Cat.*, 8th edit., 1886.)
- * *R. Radula*, W. and N., 43, and var. *Leightonii*.
- * *R. K  hleri*, Weihe. 42.
- * *R. fusco-ater*, Weihe. 42.
- R. humifusus*, Weihe. 42. *R. saxicolus*, P. J. M  ll.
- * *R. Guntheri*, Weihe. 40. *R. flexuosus*, M. and L.
- R. Menkei*, 40, W. and N.
- * Var. *pyramidalis*, Bab. *R. pyramidalis*, Bab., is now *R. longithyr-siger*, Lees. See Bab. *Notes on Rubi*, J. B., Vol. XVI., p. 177. 40.
- * *R. Bellardi*, Weihe. 41 (*R. glandulosus*, Bellard), and var. *Lejeunii*, now considered a distinct species.
- * *R. hirtus*, W. and N. 40.
- * *R. dumetorum* var. *ferox*. 40. *R. diversifolius*, Lindl.
- * *R. tenui-armatus*, Lees. 40. *A form of R. Balfourianus, Blox.*
- * *R. sublustris*, Lees. 20. *The type of R. corylifolius, Smith.*
- R. deltoideus*, P. J. M  ll. 39. (*R. alth  ifolius*). *Probably intended by Mr. Lees under one of the forms of R. nemorosus*
- R. 'scabrosus*, P. J. M  ll. = *R. tuberculatus*, Bab. *One of the forms of R. nemorosus, according to Mr. Lees.*
- * *R. c  sius*, L. 39.
- * *R. saxatilis*, L. 48, Wyre Forest.
- * *Geum urbanum*. Table 10. In all the districts.
- * *G. intermedium*. 86, Sapey Brook; 123. woods above Halesowen. Table 11. Malvern, Lickey.
- * *G. rivale*. 86, Sapey Brook; 114, The Lickey; 123, 124, woods N. of Halesowen. Table 11. Sparingly in all the districts.
- Rosa cinnamomea*, xxix. Tab. 11. Severn. *Not native.*
- * *R. spinosissima*, L. Table 11. In all the districts.
- * *R. Sabini* and *Doniana*. (*Form of R. involuta*, Sm.) 6, 41, Severn D.; 72, Malvern D.; 93, Avon; 113, Lickey. Tab. 11. *Very rare. Query whether first mention of R. Sabini?*
- * *R. villosa* (*R. mollissima*, Fries, *R. mollis*, Sm). Tab. 11. In all the districts.
- * *R. tomentosa*, Sm. Tab. 11. In all the districts.
- * *R. rubiginosa*. Tab. 11. In all the districts.
- * *R. micrantha*. 67, 72. Malvern. Nevertheless in Tab. 11, Avon, Severn, Malvern.
- * *R. tinodora*. 6, 42, Severn D.; 72, Malvern; 114, Lickey; 123, Uffmoor Wood. Tab. 11. In all the districts.

- * *R. sepium*. 72, 135, Little Malvern. Tab. 11. Malvern only. *The last two roses are very doubtful. They are now known, the latter as R. agrestis, Savi; the former, as a variety of the same. Syme equates R. inodora, Fries, to Rosa Borreri, Woods, and Rosa dumetorum, Sm. E. B., pp., 212, 214.*
- * *R. canina*. Tab. 11. In all the districts.
- * *R. systyla* (var. of *R. stylosa*, Desv.), 42, near Powick; 72, Malvern Wells. Tab. 11. In all the districts. *The Powick locality is noted on page 42 in the Severn D., and on page 72 in the Malvern D.*
- * *R. arvensis*. In all the districts.

(To be continued.)

THE FUNGI OF WARWICKSHIRE.

BY W. B. GROVE, M.A., AND J. E. BAGNALL, A.L.S.

(Continued from page 66.)

509. *B. pachypus*, Fr. Woods. Rare. August to October. Under trees, the Spring, Kenilworth, Russell, Illustr. Trickle Coppice, October, 1884, determined by Dr. Cooke.
510. *B. edulis*, Bull. *B. bovinus*, With. Woods and waysides. August to November. In Packington Park! With. 311. Edgbaston Park, With. 306. Oversley Hill, Purt. ii. 664; Crackley Wood, Russell Illustr. Combe Woods! Adams. Kingswood, Hawkes! Sutton Park; near the Rectory, Sutton; Coleshill Heath and Pool; Haywood; New Park; Langley; Berkswell; Coughton Park.
- Var. *elephantinus* (With.) September. Red Rock Plantation, Edgbaston Park, With. 311. This may, however, be *B. pachypus*.
511. *B. fragrans*, Vitt. Woods. October. Combe Woods, Adams.
512. *B. impolitus*, Fr. Woods. August to October. Sutton Park; New Park; Bradnock's Marsh.
513. *B. æstivalis*, Fr. Woods. Rare. Combe Ridings, Adams. Fen End.
514. *B. Satanus*, Lenz. Waysides and woods. Rare. August-September. Packington Park; Fen End.
515. *B. luridus*, Schæff. *B. rubeolarius*, With., Purt. Woods. October. Edgbaston Park, With. 309. Oversley; Cold Comfort, Purt. ii. 662. The Common, Kenilworth, Russell, Illustr. Combe Woods, Adams. Kingswood, Hawkes! Sutton Park; Trickle Coppice; Langley; Berkswell; Packington Park; Hampton-in-Arden; Poor's Wood, Honiley.

- Var. *erythropus*, Pers. A form similar to, if not identical with, this has occurred at Coleshill Pool and in Sutton Park :—Stem tall, cylindrical, dotted with red.
516. **B. laricinus**, Berk. Woods. Rare. September-October. Warwick, *Perceval*. Hopsford, near Brinklow, *Adams*. Trickle Coppice.
517. **B. scaber**, Fr. *B. bovinus*, vars. 3, 4, With. *B. aurantiacus*, Purt. Woods. Frequent. September-October. Pastures, Edgbaston, With. 307. Oversley Wood! Ragley Woods! *Purt.* ii. 661. Warwick, *Perceval*. Kenilworth! *Russell, Illustr.* Ansty, *Adams*. Hams Hall, *Hawkes*. Sutton Park; Trickle Coppice; Hampton-in-Arden; Wood near Bannersley Pool; Newlands Wood, near Hatton; Windley Pool; Coleshill Pool and Heath; Edgbaston Park; The Spring, Kenilworth; Coughton, &c.
518. **B. felleus**, Bull. Woods. Rare. October. Combe Ridings, *Adams*. Sutton Park.
519. **B. castaneus**, Bull. Woods. Rare. September-October. Crackley Wood, *Russell, Illustr.* Lodge Wood, Warwick, *Perceval*.

Genus XVIII. FISTULINA. Bull.

520. **F. hepatica**, Fr. *Boletus*, Purt. In the crevices of living oaks. Local. July to October. Dunnington; Alne Hills, *Purt.* ii. 670. Warwick, *Perceval*. Abbot's Oak, near Kenilworth, *Russell, Illustr.* Combe Park, *Adams*. Solihull. *Hawkes!* Hartshill Hayes, *Bloxam*. Sutton Park; Marston Green; Packington Park.

Genus XIX. POLYPORUS. Fr.

521. **P. leptcephalus**, Fr. On tree trunks. October. Crackley Wood, *Russell, Illustr.*
522. **P. rufescens**, Fr. *Bol. biennis*, Purt. On the ground. Rare. Near Alcester, *Rufford in Purt.* ii. 667. Burton Green Wood, *Russell, Illustr.* Solihull Park, *Wilkinson!* Ansty, *Adams*. Coleshill Heath; near Alveston Heath; Wappenbury; Grove Park.
523. **P. squamosus**, Fr. *Boletus squamosus*, With. On trunks of trees, especially ash and elm. Frequent. July to March. Edgbaston, With. 317. Warwick, *Perceval*. Ansty, *Adams*. Sutton; Middleton Heath; Plant's Brook Reservoir; Shustoke; Drayton Bushes; Stoneleigh Abbey; Solihull; Stechford, &c.

524. *P. varius*, Fr. *Boletus polyporus*, With., Purt. On trunks. Facing the cottage by the Park Gate, Edgbaston, *With.* 305. On an old willow at Alcester Mill, *Purt.* ii. 667. Hopsford, *Adams.* Sutton; Shustoke; on old willows, Salford Priors.
525. *P. elegans*, Fr. *Boletus calceolus*, With., Purt. On trunks. October. Stump of an ash tree, Edgbaston, *With.* 318. On an old poplar, by the side of the Arrow, at Coughton Mill, *Purt.* ii. 666. Burton Green Wood, *Russell, Illustr.*

(To be continued.)

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—MICROSCOPICAL SECTION.—March 3rd. Mr. J. Levick in the chair. Mr. W. P. Marshall exhibited a specimen of locomotive boiler tube fractured by explosion. Mr. T. V. Hodgson then read a paper on "Worms." He began by drawing attention to the structure of the Turbellarians, so common in all fresh waters. Dealing more fully with the parasites, special mention was made of that terrible pest, the liver fluke, *Fasciola*, and its triple alternation of generations; *Bilharzia*, the scourge of the Egyptian fellaheen; and the tapeworms, more particularly *Tænia echinococcus*, the progenitor of the common hydatid. Then passing on to the annelids, he dealt somewhat briefly with the leeches and earthworms; but pointed out that many of the marine worms might fairly compete with the more highly organised birds and butterflies for beauty and brilliancy of colour. The skilful structure of the protective tubes of many of these worms was alluded to, and a few remarks on the rotifers brought the paper to a close. The paper was illustrated by a series of ten diagrams, and as many living specimens under the microscope and a few others.—BIOLOGICAL SECTION.—March 10th. Mr. W. B. Grove, M.A., in the chair. Mr. T. V. Hodgson exhibited a pupa from Brazil, also hair of Sea Mouse, *Aphrodite aculeata*. Mr. W. P. Marshall exhibited two nests of a Trap-door Spider from Malta. Mr. J. E. Bagnall exhibited for Miss J. R. Gingell, a fine series of mosses, collected from the neighbourhood of Stroud, including *Fissidens adiantoides*, *F. decipiens*, and other rare and local species. Messrs. R. W. Chase and A. H. Martineau were elected president and secretary of this section for the ensuing year. Mr. J. E. Bagnall, A.L.S., then exhibited, for Dr. Fraser, a fine series of Norwegian and Arctic plants, with notes on the geographical distribution. Amongst the more noticeable were *Ranunculus hyperboreus*, *R. lapponicus*, *R. nivalis*, *R. pygmaeus*, *R. glacialis*, *Draba nivalis*, *Arabis alpina*, *Lychnis alpina*, *L. apetala*, *L. affinis*, *Sagina nivalis*, *Papaver nudicaule*, *Linnea borealis*, *Cornus suecica*, *Primula sibirica*, and *Pedicularis Sceptrum*. An interesting discussion followed, in which Messrs. W. B. Grove, Dr. Lapworth, W. P. Marshall, C. J. Watson, and J. E. Bagnall took part.—GEOLOGICAL SECTION.—March 17th. Mr. T. H. Waller, B.A., B.Sc., in the chair. Mrs. Isabella Moyles, The Beeches, Ladywood Road, was unanimously

elected a member of the society. Mr. F. W. W. Howell gave a most interesting address on "South Iceland," and exhibited geological and other specimens. The paper was illustrated by lantern views. A cordial vote of thanks was unanimously given to the lecturer.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—February 23rd. Mr. J. Madison exhibited a specimen of *Triton variegatum*, from the West Indies; Mr. J. W. Neville, specimens of *Spatangus*, from the North Sea; Mr. J. Collins, fossil diatoms from a marine deposit in Russia.—March 2nd. Mr. A. W. Haines, B.Sc., delivered a lecture on "The Anatomy of the Earthworm," the President (Professor Hillhouse, M.A., F.L.S.), in the chair. The lecturer said it would be necessary to know something of the lower animals to understand properly the one under consideration. Commencing with the amæba, the lecturer passed on to the hydra and actinia. In these there is a double layer of cells in the body wall, an ectoderm and endoderm; a little higher, in the lower worms, there was a third layer, a mesoderm. In the earthworm we had a cylindrical and typically segmented animal. The structure of the following parts was dealt with in detail—epidermis, muscular structure, alimentary canal, calciferous glands, setæ and attached muscles, reproductive and digestive organs, circulatory, excretory, and nervous systems. The lecture was illustrated by diagrams, drawings, microscopical preparations, and three dissections of the creature. On the motion of Mr. S. White, seconded by Mr. J. W. Neville, a hearty vote of thanks was accorded the lecturer.—March 9th. Mr. J. Collins exhibited a collection of the rarer plants of the county of Cork, from the herbarium of Mr. R. A. Phillips; Mr. Deakin, fossils from Wenlock limestone, Aldridge.—March 16th. Special.—Entomology. Mr. J. W. Moore showed specimens of *Bankia argentula*, from Ely; Mr. C. P. Neville, Scotch argus, *Erebia blandina*; Mr. Deakin, insects from British Burmah, caught on board ship; Mr. J. Collins, brilliant beetles from Ceylon; Mr. J. W. Neville, slides of types of antennæ of butterflies and moths; Mr. Linton, eggs of Cinnabar Moth and other insects.

OXFORD NATURAL HISTORY SOCIETY.—Feb. 26th. An interesting lecture was given by Mr. A. F. Stanley Kent, M.A., entitled "Our eyes and how we use them," illustrated by numerous diagrams, lantern slides, and specimens.—March 12th. Mr. G. C. Druce, M.A., F.L.S., gave a lecture on "The Botany of the Killarney District." He described the geology and the climate of the south-west portion of Ireland, remarking that the humid atmosphere was exactly suited to ferns, which were found in great luxuriance and abundance, especially the *Osmunda regalis*, which grows to the size of a small tree; as also the *Arbutus* and the *Saxifrages*. The luxuriance of the vegetation added much to the beauty of the landscape. But the numbers of species diminished as one travelled westward. Of the 10,000 European species 5,092 were found in Spain, 1,833 in Britain, and 1,019 in Ireland. The lecture was illustrated by lantern slides, showing some of the most lovely scenery, as well as places of historical and botanical interest; and also by a number of dried specimens which included all the plants peculiar to Ireland, principally collected by the lecturer during a recent visit to that country. Amongst them *Fumaria densiflora*, an undescribed species of *Rubus* new to Ireland, *Barbarea arcuata*, *Fumaria Boræi*, *Rosa involuta*, *R. villosa*, and *R. rubiginosa*, new to the south of Ireland, and many others.

ANIMAL PEDIGREES.*

BY A. MILNES MARSHALL, M.A., M.D., D.SC., F.R.S.,
BEYER PROFESSOR OF ZOOLOGY IN OWENS COLLEGE, MANCHESTER.

There are few things in which men take greater pride, or from which they derive more solid enjoyment, than in tracing out and publishing to the world their pedigrees; and we must acknowledge that the proceeding itself, and the satisfaction obtained from it, are entirely legitimate. For we all have pedigrees; for two or three generations each one of us could give his descent, trace his pedigree, off hand; and if we fail in attempting to go further back we know that this is from lack of knowledge, not of facts.

Would we learn these facts, we know that there are those whose profession it is to supplement our deficiencies of memory or of information on these points, and who are prepared, for a sum of half-a-crown, to provide the enquirer with a duly attested pedigree dating from the time of the Conquest. For a guinea a Roman emperor can be obtained; while the avaricious in such matters, who are prepared to spend a five pound note, may satisfy themselves, and for all we know truthfully, of their descent from a Pharaoh of the 19th dynasty.

The mode of construction of such pedigrees, or genealogical trees, is familiar to us all from our school days. We begin by ruling a series of horizontal lines, which we agree shall represent successive generations. Then, assuming that we are of those whose aspirations are satisfied by a two-and-sixpenny ancestry, we commence with the dawn of respectability in the year 1066, and gradually trace upwards from this date the line representing our descent from the selected progenitor.

We indicate in capitals, or in italics, any kings, or statesmen, or poets, or other eminent people whose memories we like to think derive renewed lustre from association with ourselves; and to include a sufficient number of these we trace the side branches of our tree for some distance; finally, on the topmost twig, and in largest letters, we write—John Smith.

* An address delivered before the Birmingham Natural History and Microscopical Society, October 14th, 1890; and based upon the Presidential Address to the Biological Section, at the meeting of the British Association for the Advancement of Science, at Leeds, in September, 1890.

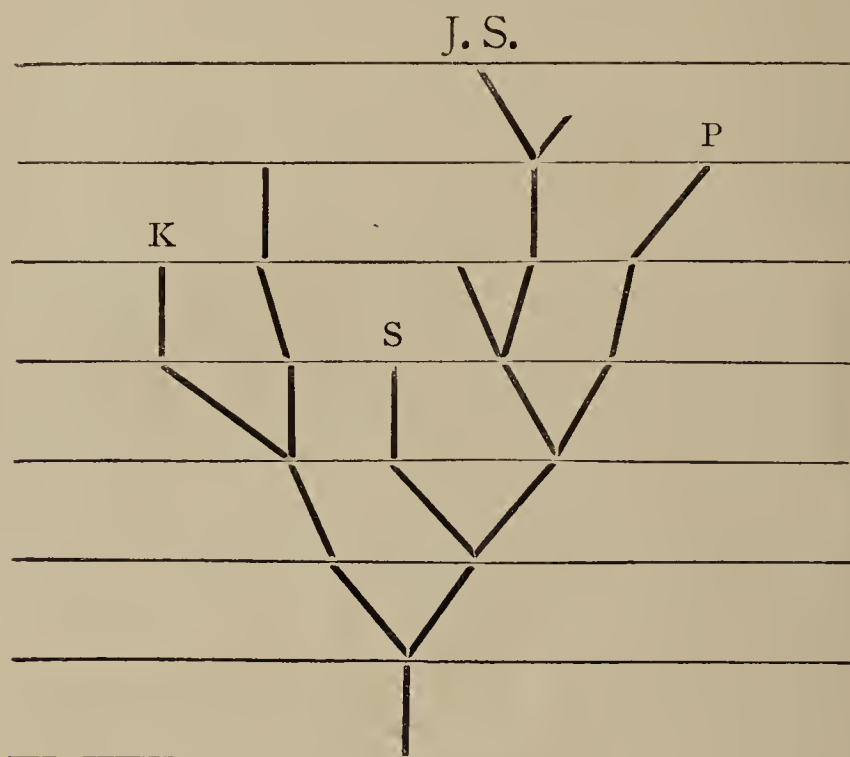


DIAGRAM A.

We all have such pedigrees, whether we can declare them or not ; and for the prince and the pauper they are of equal length, dating back, not merely to the Norman Invasion of England, but to the first appearance of man on the earth.

A special point with regard to these genealogical trees, and one to which attention may well be directed, is their absolute truthfulness. Suppose, for example, you have three young friends, two of whom, Tom and Dick, are brothers, while Harry, the third, is their first cousin ; then the diagram, or genealogical tree, representing their mutual relationships will be as follows, the horizontal lines marking successive generations :—

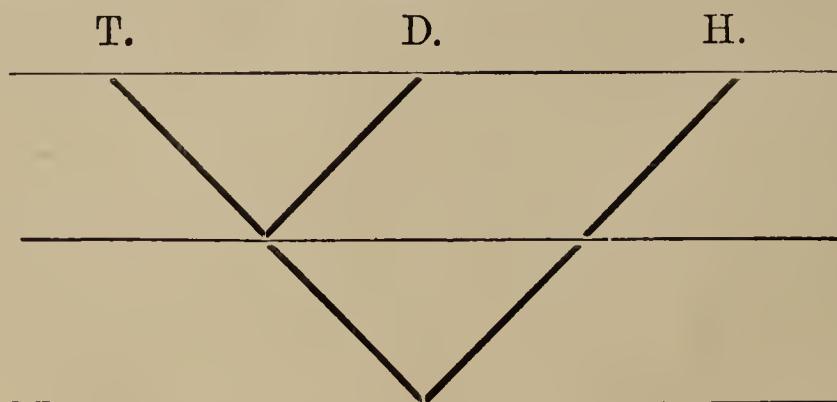


DIAGRAM B.

Go back one generation, and Tom and Dick's lines meet, for they are sons of one father. Before Harry's line joins in it is necessary to go back one generation further, *i.e.*, to the grandfather of our young friends, who was one and the same person for all three, and who forms the true link or bond of union between them. If once these relationships are determined correctly, and the diagram constructed aright then it

expresses facts, and facts only, and can never be disturbed. It matters not what the occupations or residences of the three may be ; they may never see one another ; never even suspect one another's existence. It makes no difference how many people may be living contemporaneously, how many may have preceded, how many may be born in after ages ; this little bit of history remains untouched and absolutely true for all time. It is for this reason that genealogy or blood relationship affords the only satisfactory basis for a classification of men ; and we shall find that the same considerations apply to the lower animals as well.

One further matter of a preliminary nature requires mention. It is customary in preparing genealogical tables to construct them as is done above, starting from some one more or less remote ancestor, and following upwards the branches representing his descendants, so that the whole diagram takes the form of an upright tree. It should be noted, however, that in a certain sense the diagram would be more correct if it were inverted. In tracing back human pedigrees there is a marked tendency to follow out one special line of descent, and to concentrate attention on one particular ancestor from whom we desire to make our line arise, ignoring the fact that there were many other contemporary ancestors, from any of whom our path might with equal truth have commenced.

A man has two parents, four grandparents, eight great-grandparents ; *i.e.*, in tracing back his pedigree from the present time the number of his ancestors in each generation is double those of the generation that succeeded it in time. This is graphically expressed in the following diagram :—

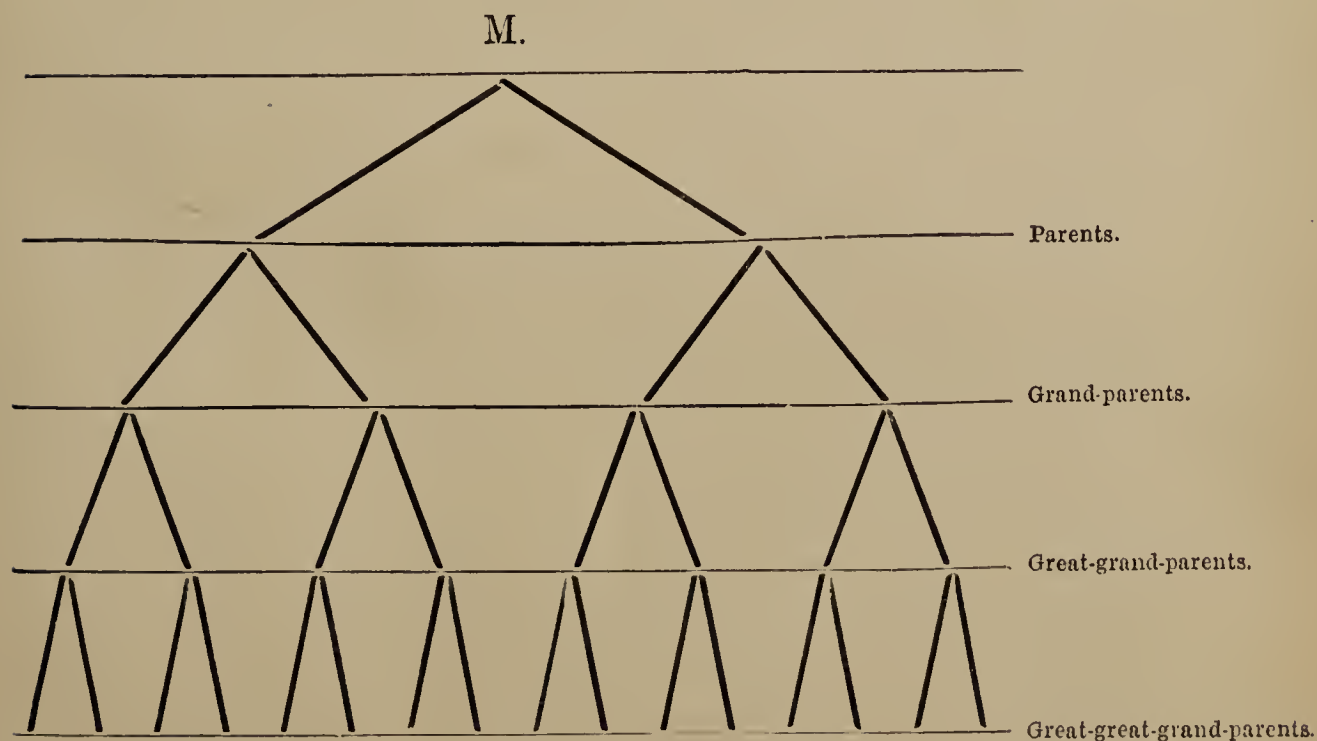


DIAGRAM C.

which takes, as noted above, the form of an inverted, not an erect, tree. If we allow three generations to a century there will have been twenty-five generations between the Norman Invasion and the present time: so that a man now living may be descended not merely from one ancestor who came over to England in 1066, but directly and equally from over sixteen million ancestors who lived at or about that date. I say "*may* be descended" advisedly; for unless we assume that many of these ancestors were identical individuals, we shall find that the existence of a single man to-day involves the existence, a thousand years ago, of over a thousand millions of ancestors; and at the commencement of the Christian era of nearly seventy thousand millions of millions of ancestors; a state of things which would involve serious reconsideration of the dimensions of the earth.

Genealogical trees, such as I have described, we are all familiar with. Furthermore, we know that the principles employed in constructing them are not confined to Smith and Jones and the kings and queens of England, but apply to the lower animals as well. The pedigrees of racehorses, and of other artificially bred animals, such as cattle, sheep, pigs, dogs, pigeons, poultry, etc., have for many years past been kept with the most scrupulous care; and there are men who could tell you in detail the pedigree of the winner of last year's Derby or Leger, who would be sorely perplexed if asked for their own, and would perhaps prefer that the results of researches on this point should not be made too public.

We all recognise that the cats and rabbits and dogs of to-day did not come into existence spontaneously, but are descended from the cats, rabbits, and dogs of preceding generations, decades, or centuries; and that the same applies to birds, to butterflies, to sea anemones, or to any other animals we like to think of.

We have now merely to enlarge our sphere of action, to widen our boundaries with regard to such genealogies, and we find ourselves face to face with the great problem with which naturalists are confronted, and which they are attacking on every side and by all means in their power.

We recognise that Diagram A represents correctly the relation between man and man: and we admit that it is equally true when applied to horses, to cows, to dogs, or to canaries. In other words, we acknowledge that the principle on which the diagram is constructed is true in all cases in which historical or documentary evidence is forthcoming.

Can we not go further than this? Is this written testimony essential? Would the facts be in any way altered if no documentary evidence were forthcoming? Do we not agree that all animals have had pedigrees of this kind; and is it not worth enquiring whether we cannot reconstruct, unravel these pedigrees, even in cases where of necessity documentary evidence cannot be obtained?

Again, to return for a moment to the human argument. So far, our horizontal lines have been used to indicate successive generations, and the relation, admitted by all, has been that each generation has sprung from the preceding generation, and has, in its turn, given birth to the next succeeding one.

Supposing now that we widen our boundaries, and agree that the intervals between successive horizontal lines shall indicate, not generations, but longer intervals, say centuries, the relations will remain unaltered.

	XIX Century.
	XVIII Century.
	XVII Century.
* * * *	XVI Century.
	XV Century.
	XIV Century.

If, for example, we fix our attention on the sixteenth century, we find that the men of that century did not arise spontaneously, but were the direct descendants of those of the preceding or fifteenth century; furthermore, we all admit that from the men of the sixteenth century those of the seventeenth, eighteenth, and nineteenth centuries have all directly sprung. And what holds good with regard to the men of the sixteenth century applies equally well to the horses, the cats, the dogs, the birds, the butterflies, the starfishes of that time.

Now widen the intervals still further: let them represent not merely centuries but thousands, tens of thousands, of years; let them finally indicate the great geologic periods, and the argument will still hold:—

	Quaternary and Recent.
	Pleiocene.
* * * *	Meiocene.
	Eocene.
	Cretaceous.

The animals, and for that matter the plants too, of the Miocene age, did not come into existence irrespective of pre-existing animals and plants, but were the direct lineal descendants of the Eocene animals and plants; and the forefathers of those of Pleiocene and Recent times.

	Kainozoic.
* * * *	Mesozoic.
	Palæozoic.

So, too, were the animals of Mesozoic times the children of those of the Palæozoic age, and the parents of the Kainozoic fauna.

And so this idea of continuity of life from its earliest dawn on the earth, through age after age, down to the present time, forces itself upon us: an idea involving the further conception of the evolution of existing animals from unlike ancestors of former times: an idea constraining us to admit that animals, like men, have pedigrees, and that between the animals of all ages a kinship, a blood relationship, exists.

The recognition of this kinship is the determining feature of the Natural History of to-day. The reconstruction of these pedigrees is the great work of the future: the rewriting of the past histories, not merely of one or two groups for a limited number of generations, but of all animals and for all time:—a formidable, but an entrancing, problem; and whatever misgivings I may have as to my power of presenting it aright, no apology is needed for asking your attention to a consideration of the means at our disposal for attacking it, of the evidence on which we rely in our attempts to reconstruct the past histories, to determine the pedigrees of animals.

On the present occasion, it is not with the whole evidence, but with one special side of it, that we shall be concerned, that, namely, which is derived from a study of the development of existing animals. Everyone knows that animals in the earlier stages of their existence differ greatly in form, in structure, and in habits from the adult condition; a lung-breathing frog, for example, commencing its life as a gill-breathing tadpole; and a butterfly passing its infancy and youth as a caterpillar. It is clear that these developmental stages, and the order of their occurrence, can be no mere accidents; for all the individuals of any particular species of frog, or of butterfly, pass through the same series of changes. It is not, however, until recent years that naturalists have realised that each animal is constrained to develop along definitely determined lines; and that the successive stages in its life history are forced on an animal in accordance with a law, the determination of which ranks as one of the greatest achievements of biological science.

The doctrine of descent, or of Evolution, teaches us that as individual animals arise, not spontaneously, but by direct descent from pre-existing animals, so also is it with species, with families, and with larger groups of animals, and so also has it been for all time; that as the animals of succeeding generations are related together, so also are those of successive geologic periods; that all animals, living or that have lived, are united together by blood relationship of varying nearness or remoteness; and that every animal now in existence has a pedigree stretching back, not merely for ten or a hundred generations, but through all geologic time since the dawn of life on this globe.

The study of Development, in its turn, has revealed to us that each animal bears the mark of its ancestry, and is compelled to discover its parentage in its own development; that the phases through which an animal passes in its progress from the egg to the adult are no accidental freaks, no mere matters of developmental convenience, but represent more or less closely, in more or less modified manner, the successive ancestral stages through which the present condition has been acquired.

Evolution tells us that each animal has had a pedigree in the past. Embryology reveals to us this ancestry, because every animal in its own development repeats its history, climbs up its own genealogical tree.

Such is the Recapitulation Theory, hinted at by Agassiz, and suggested more directly in the writings of Von Baer, but first clearly enunciated by Fritz Müller, and since elaborated by many, notably by Balfour and Ernst Haeckel.

A few illustrations from different groups of animals will best explain the practical bearings of the theory, and the aid which it affords to the zoologist in his attempts to reconstruct the pedigrees of animals; while these will also serve to illustrate certain of the difficulties which have arisen in the attempt to interpret individual development by the light of past history; difficulties which I propose to consider at greater length.

(To be continued.)

THE ARAN ISLANDS.*

BY PHILIP B. MASON, F.L.S., F.Z.S., ETC.

WITH ILLUSTRATIONS FROM PHOTOGRAPHS BY MESSRS. J. E. NOWERS
AND J. G. WELLS.

(Concluded from page 76.)

The most important ruin is that of the Church of St. Benan or Benignus, the gem of early Irish churches (Plate V., fig. 9). In the interior the length is only 10ft. 10in. and the breadth 6ft. 10in. The original height of the gable was 17 feet. It stands nearly N. and S., and is constructed of huge blocks of stone—one block alone forming almost the whole of the western side. This church undoubtedly dates back to the 6th century, and the roof was formed by over-lapping stones. Around it have been other churches, especially one dedicated to the Blessed Virgin; and near it is the ruin of St. Benan's humble hermitage, which is partly sunk in the rock. Within a few yards are the ruins of a rude stone cashel, containing several chambers, and also a cluster of cloghauns, while at the bottom of the slope below it is seen the remains of St. Eany's Monastery. In addition to these, all within an area of less than a quarter of a square mile, are to be found the stump of a round tower, the ruin of an Elizabethan castle, and three curious sepulchral monuments erected about the end of the seventeenth century, making Killeaney a veritable museum of antiquities.

The next ruin to which I shall refer (Plate V., fig. 10) is situated in the private grounds of Mr. Johnstone, of Kilmurvey, and is another remarkable example of the cyclopean masonry of the 6th century, some of the stones being 10 feet long and 20 inches thick. The doorway is shaped like that of an Egyptian tomb and certain of the windows are of extreme antiquity, with lintels formed by two leaning stones. This church is dedicated to St. Colman McDugh, who founded the diocese

of Kilmacduagh; and is also placed among the ruins of monastic buildings. This photograph of the interior shows work of a much later date, as also do some of the windows.

I will not attempt a description of many of the churches, but I must refer in a few words to another ancient Irish peculiarity, viz., the tendency to group churches together. In Aran there are the ruins of a group of seven churches all built in a little rocky glen, and within the walls of a small field, which are also intermingled with monastic ruins. I may say that this is not the only place in Ireland where seven churches are built together. The founder was St. Breccan, the grandson of Carthan Finn, the first King of Thomond, who was baptised by St. Patrick himself. About ninety years ago his grave was opened, and in it was found a well-shaped skull, supposed to be that of the saint; this was reburied (Plate VI., fig. 11). The ruins of Teampul Breccan now consist of chancel and nave, the chancel being of much more modern date, possibly 12th century work, the chancel arch and lancet window being very fine pieces of masonry, while the nave is built in a ruder manner with cyclopean windows. Here may also be seen a finely engraved terminal cross, various inscribed stones, one marked "VII. Romani," and near them are the well and bed of St. Breccan, two richly carved crosses which have been broken and put together again, on one of which is a crucifixion and on the other the knots and interlaced work of the usual Irish type, and another prayer-well to the north of the ruins.

On the large island the other churches are the beautiful ruin at St. Eany's grave, the two churches of Kilronan, St. Soomey's, the Church of the Four Beautiful Saints, and St. Kieran's, near the large mound which marks the site of the great Connaught Monastery. The east window of this church is the most perfect specimen of church architecture of its kind now to be found in Ireland. Near it are two stone crosses.

On the middle island is to be seen the ancient oratory of St. Cananagh (Plate VI., fig. 12). This is also of sixth century date: the doorway is constructed of large stones; the lintel is only 19 or 20 inches wide, and the roof was formed by overlapping stones. There are also the ruins of a church dedicated to the Holy Virgin, the rudely built and nearly destroyed Church of the Seven Kings, and the Tomb and Holy Well of the Virgin St. Kenerga.

On the southern island are the ruins of the Church of St. Gobuet and picturesque remains of the Abbey of St. Kevin of Aran.

The mediæval antiquities are not so numerous, the most striking example being Furmina Castle on the south island. There are none on the middle island, and on Ara Mor are to be seen the ancient foundations of a small square castle of the sixteenth or seventeenth centuries, near the Seven Churches, the walls of which are of uncommon thickness; St. Martin's Tower, on the south cliff, about which I could get no information; and finally Arkin Castle, which faces the sea at Killeaney. This requires some notice, as it enjoys the distinction of being the last stronghold which held out for the Royalist cause during the Parliamentary war; it was not reduced until something like six months after all resistance had ceased elsewhere.

Arkin Castle, now a ruin, was originally built in the time of Elizabeth, but was enlarged and strengthened after it fell into the power of the soldiery of Cromwell, at the expense of the material procured by the destruction of the Monastery of St. Eany, the only remains of the latter to be seen at the present day being a handsome cross placed in the middle of a field. This was one of the most important positions in the west of Ireland, giving to its owner the command of the whole trade of Galway, then one of the most important sea-ports in the kingdom. An attempt has been made to restore Galway to this position by making it the point of departure for America, instead of Moville and Queenstown, but after the loss of one or two of the steamers the attempt collapsed.

About the 13th century these islands were in the possession of the O'Briens, of Tourea, in Thomond, and in subsequent years they were a source of continual warfare between this sept and that of the O'Flaherties of West Connaught; until, in the time of Queen Elizabeth, Sir Murrough O'Flaherty succeeded in expelling the O'Briens and obtained possession of the Great Island, after which the Queen declared both parties to be traitors, and seized Aran as her own. After that time all patents for land in Jar-Connaught were granted to be held as tenants of the Queen's Manor of Arkyn.

I now come to the last subject of archæological interest on which I shall say a few words, viz., that of sepulture and the memorials of the dead. Of prehistoric burial there is little trace; all I saw were a few menhirs, or standing stones as they are called in Cornwall, in the vicinity of the Church of the Four Beautiful Saints; and I believe that no cromlech, kistvaen, or barrow, is known to exist on any of the islands. Of course, when the old churches were in daily use, there

were burial places in connection with them, but the grave had generally to be excavated in the solid rock, as is the case now with interments in the God's acre of the Protestant church at Kilronan.

Practically there are only two places now used for burial in Ara Mor, one at Kilmurvey and the other at St. Eany's grave. The latter is situated in the sand dunes just above the sea shore; and, as these sands are moved about by the action of the wind, fragments of coffin boards and whitened bones, especially vertebræ and ribs, are constantly found littered over the adjoining sands. A similar condition of things is also to be seen on the southern island, but at a greater distance from the shore. Although the islanders see no irreverence in stabling their domestic animals in the deserted churches and crunching the bones of their ancestors under foot, any attempt to carry away these bones would be bitterly resented.

The impossibility of erecting permanent memorials of the dead above the graves themselves has led to the singular custom of erecting these structures along the roadsides within the walls of the fields. The monuments are all constructed on the type of the Fitzpatrick memorials (Plate VII., fig. 13), which are the earliest specimens I could find. The inscription on one of them is as follows:—

Pray for the so
ul of John Fitzp
atrick who Dye
d the 8 day of
February ann
o D 1709

On one of these memorials I saw recorded the patriarchal age of 104 years. I found one curious instance in which an inscription had been cut in a stone lying in the middle of a large field and there left *in situ*. In several places on the island, fields on the roadside have been selected for monuments of a less pretentious character, the humblest consisting merely of small cairns of stones (Plate VII., fig. 14). I have no doubt that these fields were originally selected from some religious association, but of what nature I am ignorant.

The result of the various immigrations has been the production of a race of people of medium height, but well built and apparently healthy. The men support themselves partly by cultivating the scanty patches where this is possible, and there grow excellent potatoes; by feeding a few animals on the herbage growing naturally in the fissures and elsewhere, and partly by fishing. Coarse fish is very abundant off the shore, and can readily be caught from the

rocks, and fish of a better character swarm in deeper water. These resources are eked out by the manufacture of kelp from the seaweed. This is collected into heaps and left to dry. It is a picturesque sight to watch, on a dark night, the figures of men feeding the fires as it is burnt on the shore, since it is necessary to give it constant attention until the mass is completely calcined. The kelp is a source of iodine, but the price realised now is much less than it was formerly.

The islands are badly off in one respect, that is the total absence of bog. The whole of their fuel, peat, has to be brought across in boats from the Connemara shore, the boats, however, carrying back cargoes of limestone, of which that district is destitute.

Their boats are very remarkable, being a survival of the ancient curragh or coracle, and are called *cánoes* by the natives. They are 16 or 18 feet in length, and without keel. The woodwork consists of bent narrow strips of wood, both longitudinal and transverse. These are fastened together, and the bottom covered with tarred canvas instead of the hides formerly used. They are propelled by four oars not more than about four feet long and two inches wide in the blade. They are, of course, very easily upset, but if properly managed will ride over the fiercest Atlantic billows. They are so light that they are not left on the beach, but carried up to the cabins. Two men balancing a canoe on their heads can easily run with it. I once saw twenty to thirty starting on a fishing expedition one evening, the effect being most comical. The men's heads being, of course, concealed, the canoes and men looked like a procession of long-legged crocodiles.

The native diet consists almost entirely of fish and potatoes, with a little milk, Indian meal, bacon, and tea. Many of them never taste meat from year's end to year's end; and, although a sheep is occasionally killed on the island, I believe that a very large percentage never have tasted beef in the whole course of their lives. Still they seem to be hale and healthy, and many live to a good old age.

The cabins are one-storeyed, and often consist of three rooms. In the living room there is always one corner devoted to the pig, and sometimes another to the fowls; the flooring consisting of bare earth or the native rock. The pig, however, is not like ours, but is highly educated, and knows how to behave himself, so that he does not interfere with the comfort of the other members of the family.

The women affect highly-coloured shawls and petticoats, either red or blue. This is the case in the other parts of the west of Ireland, and is supposed to be due to the admixture



Fig. 9.

ST. BENAN.



Fig. 10.

ST. COLMAN MCDUAGH.



Fig. 11.

ST. BRECCAN.



Fig. 12.

ST. CANANAGH.



Fig. 13.

FITZPATRICK MONUMENTS.



Fig. 14.

CAMPO SANTO, NEAR KILMURVEY.

of Spanish blood, which exists here to a considerable extent. The woollen shawl is of universal utility, serving also for bonnet and umbrella and for the carriage of the baby, a load of peat, &c.

The women and children are generally barefooted; and it is astonishing how they run over sharply-pointed rocks which are painful to our well-shod feet. The men nearly all wear a kind of moccasin made of cowhide, with the hair worn outside; they are so fashioned that a single string on each side draws them tight and fastens them over the top of the foot. These are called pampoutties, and when removed in the evening are put into a bucket of water to keep them pliable, and enable them to cling closely to the foot.

The race is a prolific one, and the population is only kept within bounds by emigration to America, certain districts of which are chiefly peopled by them. The women mostly stay there, but the men frequently return; they find the streets too wide, and cannot endure the boots; they want their pampoutties again.

We found the people to be, as a rule, both hospitable and obliging, and the begging propensities mostly confined to the children. We were much indebted to Mr. Kilbride, the Protestant rector, and to Mr. Keen, the only doctor on the three islands, for help and information.

The people are to some extent superstitious, but my ignorance of Erse, which is the only language spoken by many of them, prevented my gaining much knowledge of the folk-lore. I was, however, shown pools, said to be inhabited by strange monsters; and told that they very frequently see enchanted lands out in the ocean to the west. Probably this is a remnant of a tradition of the fabled continent of Atlantis.

HOW SLOWLY COLD DESCENDS INTO THE GROUND.

A most interesting subject has been brought into prominent notice by an article from the pen of Mr. E. J. Lowe, F.R.S., in "The Conchologist," from which we make the following extract:—

"The temperature at different depths in the ground, and the time occupied in reaching those depths, is an interesting enquiry, for we find that the cold on the 2nd February, 1888, did not reach the depth of twenty-four feet until June 6th, and that the annual range of temperature, though $44\cdot2^{\circ}$ on the ground, is only $3\cdot7^{\circ}$ at twenty-four feet. Two distinct examples will suffice to make this clear.

"Example 1.—The temperature in 1888, on February 2nd, at the Royal Observatory, at various depths:—

On the grass (minimum) 10·8°			
1 inch in the ground..	32·0°		
3 feet ,, ,, ..	39·0°	The minimum not reached till Feb. 4th.	
6 feet ,, ,, ..	43·8°	,, ,, ,,	Feb. 7th.
12 feet ,, ,, ..	44·7	,, ,, ,,	Apr. 18th.
24 feet ,, ,, ..	48·1°	,, ,, ,,	June 6th.

“The annual range of temperature for 1888 was:—

4 feet above ground in shade	69·3°
On grass	44·2°
1 inch in the ground	38·6°
3 feet ,, ,, ...	23·3°
6 feet ,, ,, ...	15·1°
12 feet ,, ,, ...	10·2°
24 feet ,, ,, ...	3·7°

“Example 2.—Reading of thermometer in 1860 on July 18th, at the commencement and in the centre of the total eclipse of the sun,* showing the amount of cold caused by this eclipse and the length of time that occurred before this cold reached various depths:—

Black bulb thermometer, in vacuo in sunshine	130·0°, this fell	65·0°
Ditto, not in vacuo	104·0	38·5°
On grass	90·5	36·5°
Half an inch in the ground	78·5	8·4°
1 inch in the ground	76·2	5·2°
2 inches ,, ...	74·4	1·9°
4 inches ,, ...	73·0	0·4°
6 inches ,, ...	71·3	0·0

“The coldest point was experienced on the ground during the total phase, but it was, twenty minutes later, half an inch in the ground; thirty minutes later, one inch deep; fifty-five minutes later, at two inches deep; an hour and a half later, at four inches deep; and this cold had not reached six inches deep in five hours, showing how slowly cold descends into the ground. Before the eclipse was total *Arion ater* and *Helix pisana* were moving about as if it were evening; the latter was exceedingly common.”

HISTORY OF THE COUNTY BOTANY OF WORCESTER.

BY WM. MATHEWS, M.A.

(Continued from page 93.)

The following varieties of *Rosa canina* Mr. Lees states to have been sent to the Rev. Andrew Bloxam, and determined by him:—

Rosa Lutetiana, Leman.
R. dumalis, Bechst.

* “These observations were recorded by myself at Fuente del Mar, near Santander, in North Spain, where I had charge of the meteorological observations for the Admiralty in the ‘Himalaya Eclipse Expedition.’”

- * *R. urbica*, Leman (= *Rosa Fosteri*).
- R. andevagensis* and *R. verticillacantha*. To one of these probably must my *glaucophylla* be referred.
- R. tomentella*, Leman. Specimens of a rose which I had referred to *R. inodora* Mr. Bloxam says is truly the above.
- R. Blondeana*, Rip.
- * *Cratægus Oxyacantha*. Tab. 11. In all the districts.
- Mespilus germanica*. Tab. 11. Severn. *Not native*.
- * *Pyrus torminalis*, communis, *Malus*. Tab. 11. In all the districts.
- * *P. domestica*, (*the old Sorb Tree of Wyre Forest*), xci., with plate. Pages 4, 5, with plate.
- * *P. Aucuparia*. 4, 70, 113, 127. Tab. 11. Severn, Malvern, Lickey.
- * *P. Aria*. 42, Wyre Forest; 104, 105, Snowhill, Broadway. But these localities are in Gloucester.
- * *Lythrum Salicaria*. Tab. 11. In all the districts.
- * *L. hyssopifolia*. 95. Avon D. Tab. 11. Avon D. (Extinct?)
- * *Peplis Portula*. 65. Malvern Chase. Tab. 11. In all the districts.
- * *Epilobium angustifolium*. 6, 24, Severn D., Lickey D.; 114.—
Var. *macrocarpum*. 6,, Bridewell, Bewdley. Tab. 11. Severn, Malvern, Lickey. *Much extended in recent years, especially on the sides of railways.*
- * *E. hirsutum*, *parviflorum*, *montanum*, *tetragonum*, *palustre*. Tab. 11. In all the districts.
- * *E. roseum*. 65, 73, Malvern D. But Tab. 11. Severn, Malvern.
- * *E. virgatum*. 65, 73, Malvern D.
- E. obscurum*, lvi. Among plants not growing as far as Yorkshire. The two species are the same. *E. obscurum*, Tab. 11, Malvern only. *Probably much more widely distributed.*
- * *Oenothera biennis*, xxix. Teme side at Powick, banks of the Arrow. Tab. 11. Avon, Malvern. *Not native*.
- * *Circæa lutetiana*. Tab 11. In all the districts.
- * *Myriophyllum verticillatum*. 42, Severn D. Tab. 12. Severn, Malvern.
- * *M. spicatum*. 42, Severn D. Tab. 12. Severn, Malvern, Lickey,
- * *M. alterniflorum*. 65, 69, 73, Malvern D. Tab. 12. Malvern only.
- * *Hippuris vulgaris*, Anders. 6, Wyre Forest; 35, 61, Longdon Marsh. Tab. 12. Severn, Malvern.
- * *Callitriche verna*, L. Tab. 25. In all the districts. *There is a confusion here. C. verna*, L., *C. vernalis*, Kützing, is a comparatively rare plant, although I have frequently found it in shallow, sandy streams in the northern part of Worcestershire. *C. stagnalis*, Scop., is frequently mistaken for it.
- C. stagnalis*, probably in all the districts, not noted in Table.
- C. platycarpa*, Kütz. (*a slight variety of the preceding*). 52. Northwick, near Worcester, Mr. T. Westcombe. Tab. 25. Severn.

- * *C. hamulosa*, Kütz. Not noted in Table. *Var. pedunculata* mentioned, nevertheless, in *Bot. Malvern Hills*, 2nd edit., p. 73, as growing on Welland Common. See "*Mid. Nat.*," Vol. XIII., p. 185. (Gathered by the writer, with Mr. Towndrow, on Castle Morton Common in 1884.)
- * *Bryonia dioica*. Tab. 12. In all the districts.
- * *Spergula arvensis*. Tab. 12. In all the districts.*
- * *Scleranthus annuus*. Tab. 12. In all the districts.*
- * *Ribes Grossularia*. Tab. 12. In all the districts. *Doubtfully native.*
- * *R. alpinum*. 121, Lickey district. Tab. 12. Malvern only. *Doubtfully native in these localities. First record.*
- * *R. nigrum*. 11, 42, Severn D. Tab. 12. Severn, Malvern, Lickey.
- * *R. rubrum*. 42, Severn D. Tab. 12. Severn, Malvern, Lickey.
- R. sanguineum*, xxix. Appearing on newly-built, thick, syenitic walls at Malvern, and on hedges near Bromsgrove. Tab. 12. Malvern, Lickey.
- * *Sedum Telephium*. 6, 18, 42, Severn D. 65, Malvern. *The two forms are separated in the Tab. 12, but not distinguished in the text.*
- * *S. album*. 65, 72, Malvern Hills. Table 12. Avon, Severn, Malvern. *Doubtfully native in first two districts, probably so in last.*
- * *S. dasycphyllum*, 6, 12, Severn D.; 95, near Evesham. Add. and Corr. Old Storage Hill. Tab. 12. Avon, Severn, Malvern.
- * *S. acre*. Tab. 12. In all the districts.
- * *S. reflexum*, xxix. Shrawley. 65. Little Malvern Church. Tab. 12. Avon, Severn, Malvern.
- S. rupestre*, xxix. Planted on walls in numerous spots. Tab. 12. Malvern. Not native.
- Sempervivum tectorum*, xxix. In all the districts. *Not native.*
- S. montanum*, xxix. Established for a half a century on an old wall in Frog Lane, Worcester. Table 12. *Not native.*
- * *Cotyledon Umbilicus*. 9, 12, Severn D. 65, 81, Malvern D. Tab. 12. Severn, Malvern, Lickey. (*The last doubtful.*)
- * *Saxifraga umbrosa*, xxix. Abberley Hill, garden outcast. Tab. 12. Severn. Not native. *Should be Malvern district.*
- * *S. tridactylites*. Tab. 13. In all the districts.
- * *S. granulata*. Tab. 13. In all the districts. (*On sandstone.*)
- * *Chrysosplenium oppositifolium*. Tab. 13. All districts except Avon.
- * *C. alternifolium*. Tab. 13. All districts except Avon. *I suspect the omission in both cases.*
- * *Parnassia palustris*. 119, 120, 138, 139. Tab. 6. Avon, Severn, Lickey. *Almost disappeared from county. Known to the author in one locality only, in the Severn district!*

(To be continued.)

* Should have appeared ante p. 19.

THROUGH NORWAY WITH THE VESEY CLUB.

(Concluded from page 90.)

Off Olden was lying the yacht of the German Emperor, and close by the two gunboats which served as guard of honour. We had purposed when returning to Faleide to take our boats past in close order, and give the Kaiser (or his yacht) a rousing British cheer, with "oar salute" the while. But

"The best laid plans of mice and men
Gang aft alee,"

and we had to do it piecemeal. And after all we knew that the Kaiser himself was not on board, but we were all too boyish in our spirits to be troubled about such a trifle as that.

At Faleide our steamer was lying, and once more we all dined together, while our boat moved again seawards. Norway, as I have said, is *par excellence*, the land of waterfalls. Every day we passed them by the score, till, excepting in the case of some one particularly attractive for its picturesque shape or surroundings, we passed them by almost unnoticed. But late this evening we saw on the precipitous south side of the fjord (Utfjord, a branch of the Nordfjord), down which we were coming, a sight which held us all entranced with its beauty. Probably a mile away from us the cliff, for little short of a quarter of a mile in length and a thousand or more feet in height, was one perfect network of silvery water. Not a patch that seemed the size of a hand was free; right and left the fleecy foam-streaks mingled together, in a position so permanent that their pattern was like lace against the black face of the rock. Oh! for but five minutes, nay, five seconds, of bright light, for the cameras to do their work; but it could not be.

Our next land expedition was of three days' duration. From Gudvangen, at the head of the Naero Fjord (vieing with the Geiranger in grandeur), we drove (Friday) up the Naerodal, best known of all Norwegian valleys, to Vossevangen, where we made two days' stay. Amongst other things we had arranged here for a ball, to which innumerable invitations had been given, our guests including a large number of the peasantry, in their picturesque dress, for here we are in the heart of the Hardanger district, where the old national costume was at its best, and is most tenacious of life. The officers of the regiment quartered here, from the colonel down to the youngest and most flirtatious sub., were also all present, our total number probably exceeding 200. Before this ball we had arranged for a *replica* of the home-coming ceremonials

of a marriage ceremony—a wedded couple of some twelve months' standing taking the principal parts. A Birmingham paper, responsible for several other picturesque additions to fact, rated us for playing with the marriage ceremony by having it performed for our benefit—about as ridiculous a complaint as if it were directed against the English hosts of some future M. Taine who had arranged for his advantage a *replica* of a wedding breakfast. The wedding procession, which wound along the road to our hotel, was headed by a burly fiddler in the quaintest costume of many colours, with a pair of stockings with enormous black and white checks, and a top hat of portentous height. The various loving-cups and other domestic ceremonials took place in the saloon of the hotel, and in the dance which followed an endeavour was made to secure a good intermixture of nationalities. As most of the Norsk gentlemen dance a waltz step of the *deux-temps* style, our ladies found them fatiguing, albeit so pleasant partners. A few of the old Norsk dances, now, alas! nearly died out, were performed by some of the older folk present, including the once popular “Springing Dance”—a sure cure, one would think, for a sluggish liver. Much like our elders at home, the old Norsk peasantry look upon their children as degenerate scions of an agile race.

In this expedition we traversed two of those remarkable bits of engineered roads which I referred to in an earlier paper—ascending one at Stalheim, where the road zigzags up the face of nearly a thousand feet of cliff, from either side of you tumbling a magnificent waterfall; and descending another about midway between Vossevangen and Eide, crossing at its mid-height the equally beautiful Skjervefos. In each of these cases the lower valley is narrow, flanked by almost vertical walls of cliff, and ending abruptly with a terminal cliff up which the road zigzags, and down which the waters of the high land above tumultuously pour themselves.

Our last expedition (Monday) was to the far-famed Vöringfos, one of the largest and loftiest of the Norwegian falls, and providing an expedition the accessories of which are interesting from end to end, not the least interesting being a road which for nearly three miles is blasted on a perfect level out of a wall of live rock, which bounds a lake over which, until a year or two back, it was necessary to row. The rock sections here showing are simply perfection, and illustrate metamorphism in all its phases, and intruded veins up to not one but several degrees. One of these veins showed a lovely miniature “fault.” The vein was about three inches in thickness, inclined at an angle of about 45° , and over a length of two feet or so this vein, with the rock in which it was

enclosed, had been subject to a downcast of about fifteen inches, the alignment of the continuation of the vein being quite undisturbed. Near the head of the lake we abandon our carriages, and continue our journey on horseback along a narrow "path" (save the mark!) made by the Norwegian Tourist Club; but though as a path it is still somewhat suggestive of the top of a Derbyshire limestone "hedge," I am bound to say that it is greatly improved since 1874, when even Norwegian horses were impossible aids to ascending it. Our great enemy, the weather, could not leave us in peace even in this grand climax of our excursion, and the natural spray of the fall was added to by a persistent drizzle, under which, however, we patiently picnicked, since cover there was none. The valley of the Vöringfos differs only in degree from the Naero and other valleys, its walls being more nearly vertical and more closely approximated, and instead of ending in a somewhat inclined cliff, up which roadmaking is possible, this valley is closed by a perpendicular amphitheatre of rock, seven to eight hundred feet in height, over one side of which the river tumbles with a fall of probably little short of 600 feet.

In our programme still one other day's excursion was included, but the weather compelled its abandonment, and with the Vöringfos our land expeditions closed, and with a rapid and fairly smooth run across the North Sea to Leith the Vesey Club expedition, all too short for the work done, was brought to a close, its last act being the expression of cordial gratitude to Captain Masson, who had, with unvarying kindness, striven to make our crowded home upon the St. Rognvald the abode of peace and plenty.

W. HILLHOUSE.

THE FUNGI OF WARWICKSHIRE.

BY W. B. GROVE, M.A., AND J. E. BAGNALL, A.L.S.

(Continued from page 95.)

- Var. *nummularius*, Fr. *Boletus nummularius*, With., Purt. On a piece of rotten stick, by the tail of the pool, in Edg-baston Park, *With.* 310. On a willow stump near Oversley Bridge, in black-lands; in a plantation at Arrow, *Purt.* ii. 663.
526. *P. lucidus*, Fr. *Boletus lucidus*, Purt. At Kenwarton, *Rufford* in *Purt.* ii. 665. At the foot of an aged oak, Oversley, *Purt.* iii. 440.

527. *P. intybaceus*, Fr. *Boletus frondosus*, Purt. On a stump near Oversley Mill, *Purt.* ii. 666. Near Tachbrook, *Perceval*. Kenilworth, *Russell, List*. Sutton Park, at the foot of an oak.
528. *P. cristatus*, Fr. Woods. Kenilworth, September, 1870, *Russell, Illustr.*
529. *P. giganteus*, Fr. *Dadalea imbricata*, Purt. On trunks. Rare. Wixford; Binton; Oversley, *Purt.* iii. 251 (*Eng. Flor.* v. 137). Lodge Wood, Warwick, *Perceval*. Dalehouse Lane, Kenilworth, *Russell, Illustr.* Brentford, near Rugby; Sutton; Edgbaston Park; Packington Park.
530. *P. sulfureus*, Fr. *Boletus*, With., Purt. On trunks. In the cleft of a large cherry tree at Edgbaston, *With.* 325. In the hollow of a tree at Kingley; Wixford; Snitterfield, *Purt.* ii. 672. Oversley, *Purt.* iii. 446. On an oak in Combe Park, *Adams*. Sutton Park; Sutton; Four Oaks; Water Orton; near Shustoke, on yew.
531. *P. heteroclitus*, Fr. *Boletus*, Purt. On the ground, on stumps partly covered with mould. Oversley; King's Coughton, *Purt.* iii. 245.
532. *P. salignus*, Fr. On the foot of an apple tree, Kenilworth, *Russell, Illustr.*
533. *P. nidulans*, Fr. On fallen trees and sticks. April to October, Warwick Castle grounds, April, 1872, *Perceval*. Crackley Wood! *Dr. Cooke*. Combe Woods, *Adams*. New Park; Water Orton; Fen End.
534. *P. fumosus*, Fr. On stumps. Oct. to Feb. Warwick, *Perceval*. Penns, *Hawkes*! Driffold Lane, Sutton; Langley.
535. *P. adustus*, Fr. On stumps. Aug. to April. Near Warwick, *Perceval*. Hopsford, *Adams*. Driffold Lane, Sutton Park; New Park; Packington Park; Edgbaston Park, &c.
536. *P. adiposus*, B. et Br. "Warwickshire, Bloxam," *Berkeley's Outlines*, 243.
537. *P. hispidus*, Fr. *Boletus velutinus*, With. On trunks of trees. On trees at Edgbaston, October, 1790, *With.* 326. Near Warwick, July, 1872, *Perceval*. Kenilworth, *Russell, List*. Ansty, *Adams*. Fillongley; Sutton; Temple Balsall; Packington Park.
538. *P. cuticularis*, Fr. *Boletus*, With. On a dead alder stump below the cascade, by the side of the brook, Edgbaston Park, *With.* 322.
539. *P. dryadeus*, Fr. *Boletus pseudo-igniarius*, Purt. On stumps or the trunks of decayed living trees. Rare. At the foot of an oak in Ragley Park, *Purt.* iii. 244. Warwick, *Perceval*. Stoneleigh Park, *Russell, Illustr.* Hams Hall; Stonebridge; Maxstoke Castle; Packington Park; Kingswood; Burton Green.

546. *P. ulmarius*, *Fr.* *Boletus*, *Purt.* On elm trees. August-September. On an elm runnel at Arrow; old elm stump, Wixford Lane; Oversley, *Purt.* iii. 243. Near Warwick, *Perceval*.
547. *P. fraxineus*, *Fr.* On old ash trees near Warwick, *Perceval*, March, 1872.
548. *P. annosus*, *Fr.* On sticks and stumps. August to May. Near Warwick, *Perceval*. Driffold Lane, Sutton; Sutton Park, on larch; Four Oaks; Coleshill Pool, on larch; Shirley, on *Rosa canina*.
549. *P. radiatus*, *Fr.* Driffold Lane, Sutton, November, 1883, September, 1884; numerous specimens on fallen alders, above Blackroot Pool, Sutton Park, October, 1887.
550. *P. versicolor*, *Fr.* On stumps, &c. Common everywhere. Warwick, *Perceval*. Kenilworth, *Russell*, *Illustr.* Ansty, *Adams*. Sutton; Middleton; Coleshill; Oldbury, &c. A pale substipitate form is not uncommon in shady places.
551. *P. Wynnei*, *B. et Br.* Crackley Wood, *Russell*, *Illustr.*
552. *P. ferruginosus*, *Fr.* On gate posts. Near Warwick August, 1872, *Perceval*. Brinklow Lane, *Adams*.
553. *P. medulla-panis*, *Fr.* *Boletus*, *With.*, *Purt.* On decaying wood. Edgbaston, *With.* 319. Oversley, &c., *Purt.* ii. 669. Ragley Woods, *Purt.* iii. 444. Sutton (?) *Boletus obliquus*, Ragley, Oversley Wood, &c., *Purt.* iii. 247, may be the same, but all these references include the sub-similar species, such as *P. vulgaris*. *P. vaporarius*, &c.

(To be continued.)

Scientific Gleanings.

A PROJECT IS ON FOOT for the establishment of a marine station at Sebastopol. The plan to be followed in its erection will, it is stated, be that of the Zoological Station at Naples, but on a smaller scale.

THE FIRST EDITION of Lord Lilford's "Coloured Figures of the Birds of the British Islands," with the exception of a few of the earlier parts, has all been subscribed for. He is, therefore, making preparation for the issue of a second edition in every respect equal to the first.

THE DEATH IS RECORDED of Mr. Tuffen West, at Furnell House, Frensham, in his sixty-eighth year. Mr. West will long be remembered as one of the best illustrators of works on natural history.

THE UNITED STATES NATIONAL WEATHER SERVICE has hitherto been under the control of the War Department. On the 1st July it will be transferred to the Agricultural Department, which seems a most judicious change.

THE KEW COMMITTEE OF THE ROYAL SOCIETY are prepared to examine, at the Kew Observatory, photographic lenses, for the purpose of testing them and of certifying their performance.

ON APRIL 3RD THE HAMLET OF ADIL-DJEVAS, in Armenia, was destroyed by an earthquake; 146 houses were destroyed and 240 other buildings were much injured. Hundreds of lives were lost.

THE ROYAL GEOGRAPHICAL SOCIETY have made the following awards:—To Sir James Hector, M.D., F.R.S. (Director of the Geological Survey, &c., of New Zealand), Royal Medal; to Dr. Fridtjof Nansen, Royal Medal; to Mr. William Ogilvie, the Murchison grant; to Mr. W. J. Steains, the Back grant (one year); to Lieut. B. L. Sclater, R.E., the Cuthbert Peck grant; to Mr. A. E. Pratt, the Gill memorial.

MR. COTTAM, F.R.A.S., has issued a smaller edition (15×12 inches) of his magnificent “Charts of the Constellations,” which will be found of great value to beginners in the study of astronomical science. A separate chart is devoted to each constellation, whilst three key maps exhibit the relative positions of the various constellations. There is some valuable introductory matter. Mr. Edward Stanford is the publisher.

THE COUNCIL OF THE SOCIETY OF ARTS, acting under the provisions of the Benjamin Shaw Trust, have offered two gold medals, or two prizes of £20 each, to the executive committee of the Congress of Hygiene and Demography, for any inventions or discoveries of date subsequent to 1885, exhibited at, or submitted to, the Congress, and coming within the terms of the Trust. Under the conditions laid down by the donor, these prizes are to be offered for new methods of obviating or diminishing risks incidental to industrial occupations.

AN INTERESTING PAPER appears in “Nature” of April 16th, 1891, on “The Wheat Harvest in Relation to Weather,” in which the general law of wheat production in England, as stated in the *Times* some years ago, is most ably discussed. The law referred to is as follows:—“The yield of wheat is proportional to the summer temperature, with the modifying conditions of rainfall, prevalence of cloud, character of the weather at blossoming time and during the harvest, and the state of growth at the commencement of the summer.” The article concludes thus:—“The wheat yield in England follows the summer rainfall inversely. Good wheat years are those of hot, dry summers. Bad wheat years are those of very wet, sunless summers.”

A GEOLOGICAL DISCOVERY in the South of England, of apparently great importance, has been made, and ought to be recorded in these pages. In the north-east of France, and in the neighbouring Belgian province of Hainault, a phosphatic chalk is worked, of which probably 40,000 tons are every year imported into this country. Consequent on the preparation of a new edition of the Geological Survey Memoir on the Geology of London, the officers of the Survey have been carefully scrutinising the area to be described. A specimen from the neighbourhood of Taplow attracted the attention of Mr. Strahan on account of its unusual characters. This led to its examination by an expert, Mr. J. Hort Player, formerly a citizen of Birmingham, who ascertained that it was composed of a mixture of phosphate and carbonate of lime in nearly equal proportions, together with a little fluoride of calcium, a common associate with phosphate of lime. The proportion of phosphate of lime ranged from 18 to 35 per cent., and it then became apparent that a phosphatic chalk little,

if at all, inferior in richness to the French and Belgian deposits existed in this country. Subsequent comparison of the French chalk with that from Taplow establishes their identity. The deposit in this country is probably of local occurrence, but it is very likely that it will be found elsewhere in the broad downs of the South of England, and should this prove to be so it will be of considerable commercial importance.

MR. HERBERT SPENCER has recently published a new and revised edition of his "Essays: Scientific, Political, and Speculative." The essays consist of three handsome volumes, royal octavo, and are uniform with his system of "Synthetic Philosophy." Formerly the essays were issued in post octavo form, and, curious to say, were mostly printed from American stereotype plates, Mr. Spencer having in the past had more numerous readers in America than in England. The volumes contain all the essays originally published in the old form (including that on "The Development Hypothesis," which contained the germs of the Doctrine of Evolution, and appeared in 1852, seven years before "The Origin of Species"), together with seven new essays written since 1882. Among the latter may be mentioned "Morals and Moral Sentiments," "The Factors of Organic Evolution," "The Ethics of Kant," and the famous essay, "From Freedom to Bondage," which has just appeared in "A Plea for Liberty," published by Mr. Murray. Scattered throughout the volumes are several notes which indicate the improved health of the author, and his progress in completing his *magnum opus*—the "Synthetic Philosophy." Mr. Spencer completed his seventy-first year on Monday, the 27th April last.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—MICROSCOPICAL SECTION, April 7th, Mr. W. H. Wilkinson (Vice-president) in the chair, and fifteen members present. The chairman called the attention of the members to the death of Mr. Burgess (an old member of the society), which took place in December last; and it was resolved that the secretary be requested to write to the widow and convey the sympathy of the members, and also to state with what high appreciation the work he has done for the society is held. Mr. W. H. Wilkinson exhibited *Sparmannia africana* from a conservatory at Sutton; also one of the blossoms under the microscope, which formed a very beautiful object, the white petals showing up the crimson nectaries and golden pollen grains. Mr. Geo. Lavender exhibited Cluster-cup fungus from barberry leaf *Æcidium Berberidis*, anther and pollen of mallow, and cuticle of geranium petal. Mr. Edmonds exhibited portion of skin of *Synapta inhaerens*, showing anchor plates *in situ*, of which he gave a description. Mr. Carpenter exhibited young oysters, *Polycystina*, &c. Mr. Bolton exhibited, under two microscopes, *Cristatella mucedo*, just hatched from the statoblast.—BIOLOGICAL SECTION, April 14th, Mr. R. W. Chase in the chair. Mr. Geo. Lavender exhibited, under the microscope, the scale insect from an oleander leaf, and Mr. J. F. Goode read some notes on the life-history of the insect. Mr. W. H. Wilkinson exhibited some lepidoptera from Perthshire, collected by Mr. S. T. Ellison, including *Grapta C. album*, *Argynnis aglaia*, *Erebia Blandina*, *Macroglossa fuciformis*, *Clostera anachoreta*, and *Bombyx*

Quercus. Mr. W. P. Marshall exhibited a specimen of *Virgularia mirabilis*, with stalk complete, collected by Dr. Stacy Wilson from the Frith of Forth. Mr. R. W. Chase exhibited photographs of egg of great auk, young of Pallas's sand grouse, &c.—GEOLOGICAL SECTION, April 21st, Mr. T. H. Waller, B.A., B.Sc., in the chair. It was unanimously resolved that Mr. Howell be requested to repeat his lecture on "Southern Iceland" at a convenient date. Mr. Waller exhibited and described a series of rock sections, on behalf of Mr. Reading. Mr. Waller gave an address upon "A Week in North Wales." He described the rocks of Penmaenmawr, Aber, Cwm Idwal, Mynydd Mawr, Snowdon, Llanberis, &c., and exhibited several fine microscopical sections. A cordial vote of thanks was given to Mr. Waller for his interesting address.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—March 23rd. Mr. H. Hawkes showed specimens of *Crocus vernus* from Nottingham; Mr. J. Collins, mosses, from the Sidlaw Hills; Mr. J. Madison, specimens of *Unio pictorum*, from Hatton, showing two distinct colours in about equal numbers; Mr. J. W. Neville, mouth organs of queen wasp.—April 6th. SPRING EXHIBITION.—The President (Professor Hillhouse, M.A., F.L.S.) showed a large collection of Alpine, Boreal, and Arctic plants gathered in Norway last year, also rock specimens, and carefully executed models of Borgund Church, carriages, &c.; Mr. H. Hawkes a series of living specimens of marine algæ, floating in water, from Llandudno and Weymouth, a collection of zoophytes from the same places, and a number of drawings of buds of various trees as they appear about Christmas, with a series of slides showing sections of the same; Mr. P. T. Deakin, birds, eggs and nests, of the Birmingham district; Mr. G. H. Corbett, Indian butterflies from the Punjaub; Mr. Linton, a case of living molluscs from Gloucestershire; the Society, birds of the district; Mr. J. W. Neville, forty magic lantern slides, illustrating insect life; Mr. J. Madison, a cluster of *Helix aspersa*, living, as seen in winter. A number of interesting objects were shown under microscopes, notably living zoophytes, shown by Mr. Hawkes. During the evening the President delivered a short address of welcome to the visitors, and referred to some of the objects on exhibition.—April 13th. Mr. H. Hawkes showed specimens of *Chalina oculata* and *Halichondria panicea*, sponges, from Weymouth, and, under the microscope, *Celepora punicosa*. Mr. J. W. Neville, shells from the Gulf of Aden; Mr. Deakin, fossils from the Lower Lias clay; Mr. Linton, some of the less common shells from Gloucestershire, living.

OXFORD NATURAL HISTORY SOCIETY.—April 23rd. The President (Professor Green) in the chair. Present, thirty-six members. Lecture by Colonel C. Swinhoe, on "Mimicry in Lepidoptera." The lecturer, after describing the theory of mimicry, followed two species of butterflies, tasteful and good for food, through seven different countries, viz., India (various parts of), Burmah, Sumatra, the Malaya Archipelago, the East and West Coasts of Africa, the Fiji Islands, and some parts of Australia; showing how they resembled the distasteful Danaids or Euplæa of the district. The bringing together of varieties of the same species from so many countries formed a very striking illustration of the fact that (so-called) mimicry was the only means of self-preservation open to this genus of butterflies. The lecture was illustrated by lantern slides, and cases of lepidoptera were exhibited by the lecturer.

Fig 1.

x 20



Fig 2.

x 30

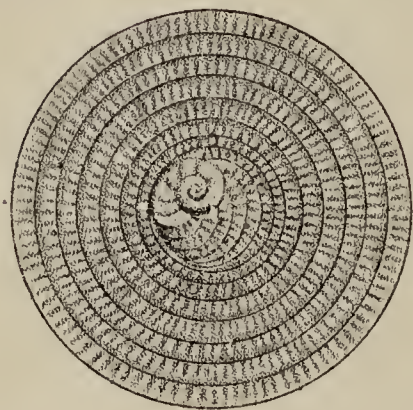
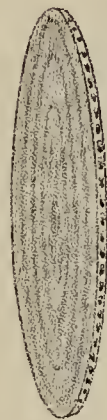


Fig 3. ORBITOLITES. Fig 4.

x 7

x 7

Fig 5.

x 4



Fig 6.

x 4

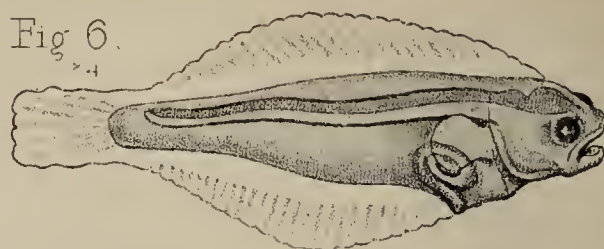
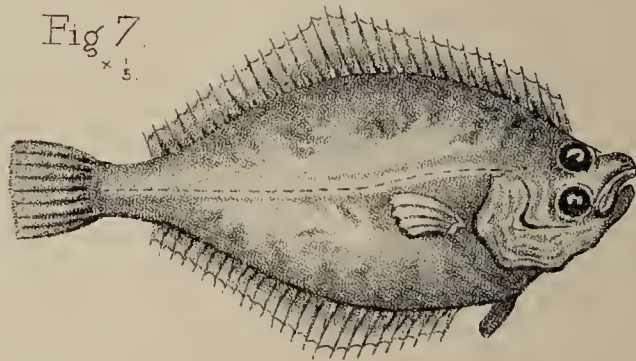


Fig 7.

x 5



FLOUNDER.

Fig 8.

x 15

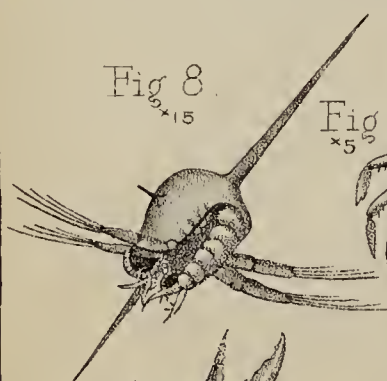


Fig 9.

x 5



Fig 10.

x 1/2



CRAB.

Fig 11.

x 90

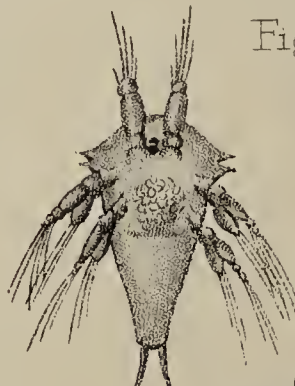


Fig 12.

x 90



Fig 13.

x 90



Fig 14.

x 1/2



SACCULINA.

Fig 15.

x 3



Fig 16.

x 3



Fig 17.

x 1



Fig 18.

x 1



FROG.

Fig 19.

x 3



Fig 20.

x 3



Fig 21.

x 3



Fig 22.

x 3



HYLODES.

ANIMAL PEDIGREES.

BY A. MILNES MARSHALL, M.A., M.D., D.SC., F.R.S.,
BEYER PROFESSOR OF ZOOLOGY IN OWENS COLLEGE, MANCHESTER.

(Continued from page 104.)

A very simple example of recapitulation is afforded by the eyes of the sole, flounder, plaice, turbot, and their allies. These "flat fish" have their bodies greatly compressed laterally, and the two surfaces, really the right and left sides of the animal, unlike, one being white or nearly so, and the other coloured. The flat fish has two eyes, but these, in place of being situated, as in other fish, one on each side of the head, are both on the coloured side. The advantage to the fish is clear, for a flat fish when at rest lies on the sea bottom, with its white surface downwards and the coloured one upwards. In such a position an eye situated on the white surface could be of no use to the fish, and might even become a source of danger, owing to its liability to injury from stones or other hard bodies on the sea bottom.

No one would maintain that flat fish were specially created as such. The totality of their organisation shows clearly enough that they are true fish, akin to others in which the eyes are symmetrically placed one on each side of the head, in the position they normally hold among vertebrates. We must therefore suppose that flat fish are descended from other fish in which the eyes are normally situated.

The Recapitulation Theory supplies a ready test; and on employing it, *i.e.*, on studying the development of the flat fish, we obtain a conclusive answer. A young flounder or other flat fish, on leaving the egg, is shaped just as any ordinary fish, and has the two eyes placed symmetrically on the right and left sides of the head. In Plate VIII., Fig. 5, the young flounder is shown six days after hatching, the eyes being still perfectly symmetrical. As the young fish increases in size, the shape gradually approaches that of the adult; the body increases in height, and becomes flattened laterally, the median, dorsal, and ventral fins becoming greatly developed at the same time; and the fish now begins to adopt the habit of the adult of lying on one side on the sea bottom. Another change occurs: the eye of the side on which the fish lies, the left side in a flounder, becomes shifted slightly forwards, then rotated on to the top of the head, and finally twisted completely over to the opposite or right side. In Fig. 6, which is drawn to the same scale as Fig. 5, the stage is represented in which the left eye is just appearing on the top of the head; while in Fig. 7, which shows the adult

flounder, the left eye is completely twisted over to the right side of the head, and lies immediately above the true right eye, which is displaced downwards, and lies immediately behind the angle of the mouth.

Crabs differ markedly from their allies, the lobsters, in the small size and rudimentary condition of their abdomen or "tail." Development, however, affords abundant evidence of the descent of crabs from macrourous ancestors. A crab leaves the egg in what is termed the zoea condition, Fig. 8, possessing a long and clearly-jointed abdomen; and throughout all the earlier stages of existence the abdomen remains at least as long as the body. At the megalopa stage, represented in Fig. 9, the shape and proportions are very similar to those of a lobster or other macrourous decapod. It is only in the last stages of development when the shape, though not the size, of the adult crab is attained, that the abdomen becomes relatively smaller, and is turned forwards out of sight beneath the hinder part of the thorax.

Molluscs afford excellent illustrations of recapitulation. The typical gastropod has a large spirally-coiled shell; the limpet, however, has a large conical shell, which in the adult gives no sign of spiral twisting, although the structure of the animal shows clearly its affinity to forms with spiral shells. Development solves the riddle at once, telling us that in its early stages the limpet embryo has a spiral shell, which is lost on the formation, subsequently, of the conical shell of the adult.

Recapitulation is not confined to the higher groups of animals, and the Protozoa themselves yield most instructive examples. A very striking case is that of Orbitolites, one of the most complex of the porcellaneous Foraminifera, in which each individual during its own growth and development passes through the series of stages by which the cyclical or discoidal type of shell was derived from the simpler spiral form.

The fully-formed Orbitolite shell is a thin calcareous disc shown full face in Fig. 4 and in profile in Fig. 3. It is hollow, and the central cavity is divided into chambers by concentric partitions or septa, well seen in Fig. 4. These chambers are further subdivided by incomplete radial partitions. The concentric partitions are perforated by numerous holes, which place the chambers in communication with one another; and the outermost or marginal chamber communicates with the outer world through a series of holes round the edge or rim of the disc, seen in Fig. 3. During life all the cavities are filled with a slimy protoplasm, very similar to that of which an Amœba consists; through the perforations in the septa the protoplasm of one chamber

communicates freely with that of the neighbouring chambers ; and through the marginal apertures at the rim of the shell pseudopodia can be protruded and food captured and ingested.

An Orbitolite grows by addition of new chambers round the margin of the shell. The protoplasm, becoming too abundant to be contained within the cavities of the shell, protrudes as a rim all round the margin of the shell, and by deposition of calcareous matter gives rise to a new chamber to the shell.

The discoidal shape of shell, so characteristic of Orbitolites, is very unusual amongst Foraminifera, and it is a matter of great interest to determine in what way it has been acquired. Bearing in mind what has just been said as to the mode of growth of the shell, it is clear that the oldest part, *i.e.*, that which alone was present in the young animal, is the central portion, and that the successive concentric rings are younger and younger as we pass outwards towards the circumference, the marginal chamber being the youngest and latest formed of the whole series. Now, if we look at the central or oldest part of an Orbitolite, we find, Fig. 4, that it has not the concentric arrangement of the peripheral part, but is coiled spirally like the majority of Foraminifera. The central, or oldest, turns of this spiral are not chambered; the outer turns are divided by partitions into chambers, and these chambers, as we follow the spiral round, become wider and wider, so as to overlap and wrap round the older part of the shell, at first partially, but ultimately completely; the first chamber that completely surrounds the shell marking the transition from the spiral to the discoidal type.

We thus find that the discoidal Orbitolite shell commences its development as a spiral shell, and acquires the discoidal character merely through an exaggerated mode of growth on the part of the spiral. The Recapitulation Theory tells us that this is to be interpreted as meaning that the discoidal shells are descended from spiral ancestors, and the close agreement between a young Orbitolite, Fig. 2, and an adult Peneroplis, Fig. 1, suggests that either Peneroplis itself, or forms closely allied to it, were the actual ancestors.

The Orbitolite is peculiarly instructive, owing to the fact that the addition of new chambers during growth takes place in such a way as to leave the older parts of the shell unaltered, and fully exposed to view, so that simple inspection of an adult shell, as in Fig. 4, reveals the whole course of development, and shows us not merely the anatomy but the embryology as well. It is as though a kitten were to develop into a cat, not by interstitial growth in all its parts, but by the addition of successive lengths to its nose, its ears,

its legs, and its tail; the additions being cleverly effected so as to leave the original kitten unaltered in the middle, and fully exposed to view the whole time.

The above examples, selected almost haphazard, will suffice to illustrate the Theory of Recapitulation. The proof of the theory depends chiefly on its universal applicability to all animals, whether high or low in the zoological scale, and to all their parts and organs. It derives also strong support from the ready explanation which it gives of many otherwise unintelligible points.

Of these latter familiar and most instructive instances are afforded by rudimentary organs, *i.e.*, structures which, like the outer digits of the horse's leg, or the intrinsic muscles of the ear of a man, are present in the adult in an incompletely developed form, and in a condition in which they can be of no use to their possessors; or else structures which are present in the embryo, but disappear completely before the adult condition is attained; for example, the teeth of whalebone whales or the gill-slits present in the neck during the embryonic phases of all higher vertebrates.

Natural selection explains the preservation of useful variations, but will not account for the formation and perpetuation of useless organs, and rudiments such as those mentioned above would be unintelligible but for Recapitulation, which solves the problem at once, showing that these organs, though now useless, must have been of functional value to the ancestors of their present possessors, and that their appearance in the ontogeny of existing forms is due to repetition of ancestral characters.

Rudimentary organs are extremely common, especially among the higher groups of animals, and their presence and significance are now well understood. Man himself affords numerous and excellent examples, not merely in his bodily structure, but by his speech, dress, and customs. For the silent letter *b* in the word "doubt," the *g* in "foreign," or the *w* of "answer," or the buttons on his elastic-side boots are as true examples of rudiments, unintelligible but for their past history, as are the ear muscles he possesses but cannot use; or the gill-clefts, which are functional in fishes and tadpoles, and are present, though useless, in the embryos of all higher vertebrates, which in their early stages the hare and the tortoise alike possess, and which are shared with them by cats and by kings.

The fossil remains of animals and of plants yield results of the greatest importance when studied in the light of the Recapitulation Theory. I have thought it well to ask special attention to these, even at the risk of repeating what has been

said elsewhere and by others, for it seems to me that zoologists are too apt nowadays to neglect palæontology, while palæontologists have a tendency to regard embryology as something beyond their own ken, and concerning them but little. Moreover, there are certain points arising from a study of fossils which, I venture to think, may possibly commend themselves to some of our members as suitable subjects for practical investigation.

The elder Agassiz was the first to point out, in 1858, the remarkable agreement between the embryonic growth of animals and their palæontological history. He called attention to the resemblance between certain stages in the growth of young fish and their fossil representatives, and attempted to establish, with regard to fish, a correspondence between their palæontological sequence and the successive stages of embryonic development. He then extended his observations to other groups of animals, and stated his conclusions in these words:—"It may therefore be considered as a general fact, very likely to be more fully illustrated as investigations cover a wider ground, that the phases of development of all living animals correspond to the order of succession of their extinct representatives in past geological times."

This point of view is of great importance. If the development of an animal is really a repetition or recapitulation of its ancestral history, then it is clear that the agreement or parallelism which Agassiz insists on between the embryological and palæontological records must hold good; and a most important field of work is thus opened up to us.

It is sometimes urged, however, that such work is necessarily unfruitful and inconclusive, because of the scantiness of our knowledge concerning life in the earlier geologic periods, or, as it is commonly termed, the imperfection of the geological record. I have elsewhere protested against this objection, and would repeat my protest here. The actual number of fossils already obtained, especially from the more recent formations, is prodigious; and what we have to do is to make the most of the material already accumulated, rather than to fold our hands and idly lament the absence of forms that perhaps never existed.

It is true that with all groups the chances are not equal. But, by judicious selection of groups in which long series of specimens can be obtained, and in which the hard skeletal parts, which alone can be suitably preserved as fossils, afford reliable indications of zoological affinity, it is possible to test directly this alleged correspondence between the palæontological and embryological histories; while, in some instances, a single lucky specimen may afford us, on a particular point,

all the evidence we require. Many serious attempts have already been made to work out in detail this comparison between fossils and the developmental stages of living forms, and the results obtained are most promising.

Following the lines laid down by his father, Alexander Agassiz has made a detailed comparison between the fossil series and the embryonic phases of recent forms in the case of the Echinoids or Sea Urchins, a group peculiarly well adapted for such an investigation, as the fossil representatives are extremely numerous and well preserved, and the existing members well known and comparatively few in number. Agassiz shows that the two records in this case agree remarkably closely; more especially in the independent evidence they give of the origin of the asymmetrical forms from more regular ancestors.

The young Clypeastroid, for example, has an ovoid test, a small number of coronal plates, few and large primary tubercles and spines, simple straight ambulacral areas, and no petaloid ambulacra; in fact, has none of the characteristic features of the adult Clypeastroid, while the characters it does possess are those of geologically older and preceding forms.

So again, in the group of Echinidæ, the members of the comparatively recent polyporous group, in which each ambulacral plate bears more than three pairs of ambulacral pores, commence their existence in the older and more primitive oligoporous condition, and become polyporous through fusion of originally distinct ambulacral plates.

Agassiz gives many other examples, and, from a careful consideration of the entire group, arrives at the conclusion that "comparing the embryonic development with the palæontological one, we find a remarkable similarity;" and again, "the comparison of the Echini which have appeared since the Lias with the young stages of growth of the principal families of recent Echini, shows a most striking coincidence, amounting almost to identity, between the successive fossil genera and the various stages of growth."

In this connection Agassiz makes a suggestion of much interest. We are apt, he says, to assume, and perhaps rightly, that enormous periods of time have elapsed during the conversion of genus to genus, but the fact that these very changes can be repeated before our eyes in a few days' or even hours' time, during the development of the individual animal, may, perhaps, afford us a hint that such enormous periods are not really necessary in historical development, but that transformation of one form to a widely different one may, under favourable circumstances, be effected with considerable rapidity.

The Echinoids, and other groups of Echinoderms as well, have been worked at from the same standpoint, and with the same results, by Neumayr, in whom we have recently lost one of the most gifted and painstaking of palæontologists.

As an example of the extreme value, in certain cases, of a single fossil specimen, the singular fossil bird, Archæopteryx, may be referred to. In recent birds the metacarpal bones of the wing are firmly fused with one another and with the distal row of carpal or wrist bones, but in development the metacarpals are at first and for some time distinct. The first specimen of Archæopteryx discovered, which is now in the British Museum, showed that in it this distinctness was preserved in the adult, *i.e.*, that what is now an embryonic character in recent birds was formerly an adult one.

Another very excellent illustration of the parallelism between the palæontological and the developmental series is afforded by the antlers of deer, which, as is well known, are shed annually, and grow again of increased size and complexity in each succeeding year. In the case of the red deer, *Cervus elaphus*, the antlers are shed in the spring, usually between the months of February and April; during the summer the new antlers sprout out, and, growing rapidly, attain their full size at the pairing season in August or September: they persist throughout the winter, and are shed in the following spring.

The antlers of the first year are small and unbranched; those of the second year are larger and branched; in the antlers of the third year three tynes or points are present; in the fourth year four points, and so on until the full size of the antler and the full number of points are attained.

The geological history of antlers has been worked out by Professor Gaudry and by Professor Boyd Dawkins, and is of great interest. In the Lower Miocene and earlier deposits no antlers have been found. In the genus *Procervulus* from the Middle Miocene, a pair of small, erect, branched, but non-deciduous antlers were present, intermediate in many respects between the antlers of deer and the horns of antelopes. From slightly later deposits a stag, *Cervus dicroceros*, has been found with forked deciduous antlers, which, however, do not appear to have had more than two points. In Upper Miocene times antlered ruminants were more abundant, and the antlers themselves larger and more complex: while from Pleiocene deposits very numerous fossils have been obtained showing a gradual increase in the size of the antlers and the number of their branches, down to the present time.

Antlers therefore are, geologically considered, very recent acquisitions: at their first appearance they were small, and either simple or branched once only; while in succeeding ages they gradually increased in size and in complexity.

The palæontological series thus agrees with the developmental series of stages through which the antlers of a stag pass at the present day before attaining their full dimensions.

There is another point of view from which fossils acquire special interest in connection with the Recapitulation Theory. If the theory is correct, it must apply not merely to the animals now living on the earth, but to all animals that ever have lived; and it becomes a matter of considerable interest to enquire whether we have any evidence whereby we can test this point, and determine whether or not the fossil animals in their own individual development repeated the characters of their ancestors.

At first sight the enquiry does not seem a promising one, for it may well be asked what possibility there is of determining the embryology or mode of development of animals which are only known to us through the chance preservation of their bones or shells as fossils.

In most cases, it is true that such determination is impossible, but in some groups as, for example, the Trilobites, great numbers of well preserved specimens have been obtained, not merely of adults, but of young forms in various stages of growth; and the study of these young forms has already yielded results of considerable interest. According to Barrande, to whom our knowledge of these early stages is mainly due, four chief types of development may be recognised, differing from one another much as existing Crustaceans do, in the relative size and perfection of the three regions, head, thorax, and tail, into which the body is divided.

Evidence of a very different kind, and often of far greater value, is afforded by the study of shells, whether of Mollusca or of Foraminifera. Such shells, like those of Orbitolites already noticed, have no power of interstitial growth, and increase in size can only be effected by the addition of new shelly matter to the part already in existence. In most instances these additions take place in such manner that the older parts of the shell are retained unaltered in the adult; and examination of the adult or fully formed shell will then reveal the several stages through which the shell passed in its development.

In such a shell, for instance, as Nautilus or Ammonites, the central chamber is the oldest or first formed one, to which the remaining chambers are added in succession. If, therefore, the development of the shell is a repetition of ancestral history, the central chamber should represent the palæontologically oldest form, and the remaining chambers, in succession, forms of more and more recent origin.

Ammonite shells present, more especially in their sutures, and in the markings and sculpturing of their surface, characters that are easily recognised. Upwards of four thousand

species are known to us, of many of which large numbers of specimens can be obtained, in excellent preservation. The group consequently is a very suitable one to study from our present standpoint; and the enquiry gains additional interest from the fact that Ammonites are an entirely extinct group of animals, no single species having survived the cretaceous period, so that our only chance of learning anything about their embryology is to study the fossil shells themselves.

Würtenberger, who has made a special study of the Jurassic Ammonites, has shown that there is the same correspondence between historic and embryonic development that obtains among living animals. In the middle Jurassic deposits, for instance, the older Ammonites are flattened and disc-like, with numerous ribs; in later forms the shell bears rows of tubercles near the outer side of the spiral, and later still a second inner row of tubercles as well, while the ribs gradually become less conspicuous, and ultimately disappear. In forms from more recent deposits the outer row of tubercles disappears, and then the inner row, the shell becoming smooth, swollen, and almost spherical.

On taking one of these smooth, spherical shells, such as *Aspidoceras cyclotum*, and breaking away the outer turns of the spiral so as to expose the more central and older turns, Würtenberger found first an inner and then an outer row of tubercles appearing, which nearer the centre disappeared, and in the oldest part of the shell were replaced by the ribs characteristic of the earlier, and presumably ancestral forms.

Results such as these open up to us a new field of enquiry, which, if energetically worked, must yield results of great interest and importance.

In order to understand fossils aright, and to derive from them the full amount of information they are capable of yielding us, it is necessary that we should have thorough knowledge of the development of their living descendants; and more especially that we should be fully acquainted with the several stages of formation of the shells or other hard parts of the recent forms, which, in their fossil representatives, are, with rare exceptions, the only parts sufficiently well preserved to give trustworthy evidence.

Embryologists have too often confined themselves to the earlier stages of development, and have unduly neglected the later stages, and more especially the later stages of the skeletal structures. By so doing they have failed to afford to palæontologists the aid which they are peculiarly qualified to give, and which to the palæontologist would be of the utmost value. Fortunately, the mistake is now recognised, and serious efforts are being made to remove the reproach.

(To be continued.)

HISTORY OF THE COUNTY BOTANY OF WORCESTER.

BY WM. MATHEWS, M.A.

(Continued from page 112.)

- * *Hydrocotyle vulgaris*. 14, Lickey D. Tab. 13. In all the districts.
- Astrantia major*, xxix. "Between Whitbourne and Malvern." Mr. Babington, from the late Mr. Borrer's information; but the spot is unknown to any Worcestershire botanist. Tab. 13. Malvern. *Not native*.
- Eryngium campestre*, Add. and Cor. Gathered by the Rev. Phipps Onslow in 1867 between Tedstone Delamere and Upper Sapey. (*Query county*.)
- * *Sanicula europæa*. 72, Malvern D. 123, Lickey D. Tab. 13. In all the districts.
- * *Apium graveolens*. 36, Droitwich Canal. 61, Longdon Marsh. 92, Avon Valley. Tab. 13. Avon, Severn, Malvern.
- Petroselinum sativum*, xxix. Tab. 13. Severn, Malvern. *Not native*.
- * *P. segetum*. 43, Severn D. 95, 97, Avon D. Tab. 13. Avon, Severn, Malvern.
- * *Helosciadium nodiflorum*. Tab. 13. In all the districts.
- Var. *repens*. Tab. 13. Avon, Severn, Malvern. *Not the true var. repens*, R. L. Towndrow.
- * *H. inundatum*. 13, Hartlebury Common, 65, Malvern Chace. 119, Moseley. Tab. 13. Severn, Malvern, Lickey. *Probably extinct at Moseley*.
- * *Sison Amomum*. 43, Severn D. 93, 98, Avon D. 114, Lickey. Tab. 13. In all the districts.
- * *Ægopodium Podagraria*. Tab. 13. In all the districts.
- * *Carum Carui*. 43, Powick. Tab. 13. Malvern.
- * *Bunium flexuosum*. Tab. 13. In all the districts.
- * *Pimpinella magna*. 6, Wyre Forest. 43, Severn D. 67, Malvern D. 92, Avon D. Tab. 13. Avon, Severn, Malvern. (*Also in Lickey District, near Longbridge*.)
- * *Pimpinella Saxifraga*. In all the districts.
- * *Sium latifolium*. 13, 43; Blakedown Pool. Purton. Extinct. Tab. 13. "*Mid. Nat.*," Vol. X., p. 256.
- * *S. angustifolium*. 43, Wick, near Powick. Tab. 13. Avon, Severn, Malvern. (*Lickey D. also, Wm. M.*)
- * *Bupleurum rotundifolium*. 43, Tibberton, &c. 93, 98, Avon D. Tab. 13. Avon, Severn, Malvern. (*Lickey D. also, Wm. M.*).
- * *B. tenuissimum*. 37, 61, Severn D. 65, Malvern D. 97, near Evesham. Tab. 13. Avon, Severn, Malvern.
- B. Odontites (aristatum)*. 94, formerly at Cracombe. Tab. 13. Avon?
- * *Ænanthe fistulosa*. Tab. 13. In all the districts.

- * *Æ. pimpinelloides*. 33, 34, 61, Severn, Malvern Ds. Tab. 13. Avon, Severn, Malvern.
- * *Æ. Lachenalii*. 35, 38, 44, 61, Severn D. 65, Malvern D. 91, 95, Avon D. Tab. 13. Avon, Severn, Malvern.
- * *Æ. silaifolia* (*peucedanifolia*). 35, 61, Longdon Marsh. 43, Kempsey. 65, Malvern Chace. Tab. 13. Severn, Malvern.
- * *Æ. crocata*. 13, 44, Severn D. Tab. 13. Severn, Malvern.
- * *Æ. Phellandrium*. 29, 44, Severn D. Tab. 13. Severn, Malvern, Lickey.
- * *Æthusa Cynapium*. Tab. 13. In all the districts.
- * *Fœniculum officinale*. 44, Powick, Crowle, Rainlow Hill, Worcester. Tab. 13. Avon, Severn, Malvern. *Not native*.
- * *Silaus pratensis*. Tab. 13. In all the districts.
- * *Angelica sylvestris*. Tab. 14. In all the districts.
- * *Archangelica officinalis*. 44, Priory Ferry, Worcester. Tab. 14. Severn. *Not native*.
- * *Pastinaca sativa*. Tab. 14. In all the districts.
- * *Heracleum Sphondylium*. Tab. 14. In all the districts.
- * *Daucus Carota*. In all the districts.
- * *Caucalis daucoides*. 44, calcareous field at Tibberton. Mr. T. W. Gissing. Tab. 14. Avon (extinct), Severn.
- * *Torilis Anthriscus*. Tab. 14. In all the districts.
- * *T. infesta*. 44, about Worcester. 98, Alderminster. Tab. 14. In all the districts.
- * *T. nodosa*. 44, near Worcester. 100, Bredon Hill. Tab. 14. Avon, Severn, Malvern.
- * *Scandix Pecten Veneris*. Tab. 14. In all the districts. (*Not common in the Lickey district*.)
- * *Anthriscus sylvestris*. Tab. 14. In all the districts.
- * *A. Cerefolium*, xxix. Tab. 14. Severn, Lickey.
- * *A. vulgaris*. Tab. 14. In all the districts.
- * *Chærophyllum temulum*. Tab. 14. In all the districts.
- * *Myrrhis odorata*. 86, Teme Valley. Tab. 14. Malvern.
- * *Conium maculatum*. Tab. 14. In all the districts.
- * *Smyrnium Olusatrum*. 38, 37, 61, Severn D. ; 91, 95, Avon D. Tab. 14. Avon, Severn.
- * *Hedera Helix*. Tab. 14. In all the districts.
- * *Cornus sanguinea*. Tab. 14. In all the districts.
- * *Viscum album*. 44, Severn D. ; 73, on an oak in Eastnor Park (*Hereford*). Tab. 14. In all the districts. (*Rare in the Lickey D.*)
- * *Adoxa moschatellina*. 44, Laughern Brook ; 104, Avon D. ; 114, 122, 130, Lickey D. Tab. 14. In all the districts.
- * *Sambucus Ebulus*. 45, S. of the Severn D. ; 131, Overend, Scott. Add. and Corr., Pendock. Tab. 14. Severn, Malvern, Lickey.
- * *S. nigra*. 45, Severn D. ; 128, Wychbury Wood. Tab. 14. In all the districts.
- * *Viburnum Opulus*. Tab. 14. In all the districts.

- * *V. Lantana*. 43, Severn D.; 69, Malvern D.; 93, 100, 104, Avon D.
- * *Lonicera Caprifolium*. 6, Bridewell; Bewdley. Tab. 14. Severn.
Not native.
- * *L. Periclymenum*. Tab. 14. In all the districts.
- * *L. Xylosteum*. 45, Powick; Westwood Pool; near Hartlebury Common; Longdon Marsh. Tab. 14. Severn, Malvern. *Not native.*
- * *Sherardia arvensis*. Tab. 14. In all the districts.
- * *Asperula cynanchica*. 99, 100, 103, Avon D. Tab. 14. Avon.
- * *A. odorata*. 45, Severn D.; 72, Malvern D.; 123, woods between Halesowen and Frankley. Tab. 14. In all the districts.
- * *Galium cruciatum*, *Aparine*, *Mollugo*, *verum*, *saxatile*, *uliginosum*, *palustre*. Tab. 14, 15. In all the districts.
- * *G. tricorne*. 45, Tibberton; 67, Malvern. Tab. 15. Avon, Severn, Malvern.
- * *G. erectum*. 57, 73, Malvern; 98, Alderminster. Tab. 15. Avon, Malvern.
- * *Centranthus ruber*. 45, old walls by Worcester Cathedral. Tab. 15. Severn. *Not native.*
- * *Valeriana officinalis*. Tab. 15. In all the districts.
- * *V. dioica*. Tab. 15. In all the districts.
- * *Valerianella olitoria*. Tab. 15. In all the districts.
- V. carinata*. 98, near Alderminster. Tab. 15. Avon, Severn. (*On the stone wall of Spring Grove, on the Kidderminster and Bewdley Road, about 1850.—Wm. M.*)
- * *V. dentata*. 100, 104, Avon. Tab. 15. Avon, Severn, Malvern. (*Also Lickey.—Wm. M.*)
- * *V. eriocarpa*. Tab. 15. Malvern. *See ante p. 16.*
- * *Dipsacus sylvestris*. Tab. 15. In all the districts.
- * *D. pilosus*. 18, 46, Severn D.; 68, Malvern D.; 119, 124, 130, Lickey D. Tab. 15. In all the districts.
- * *Knautia arvensis*. Tab. 15. In all the districts.
- * *Scabiosa Columbaria*. 98, 100, 103, Avon D. Tab. 15. Avon.
- * *S. succisa*. Tab. 15. In all the districts.
- * *Eupatorium cannabinum*. Tab. 15. In all the districts.
- * *Petasites vulgaris*. Tab. 15. In all the districts.
- * *Tussilago Farfara*. Tab. 15. In all the districts.
- * *Erigeron acris*. 6, 13, 46, 59, Severn D.; 93, 98, Avon D. Tab. 15. Avon, Severn, Malvern, Lickey.
- * *Bellis perennis*. Tab. 15. In all the districts.
- * *Solidago Virgaurea*. 30, Overend, near Cradley. Add. and Corr. Malvern D. Tab. 18. Severn, Malvern, Lickey. *Not noticed in Avon district. It must occur there.*
- * *Inula Helenium*. 85, Malvern D.; 100, Avon D. Tab. 15. Avon, Severn, Malvern.
- * *I. Conyza*. 13, 46, Severn D.; 67, Malvern D.; 100, Avon D.; 133, Dudley. Tab. 15. In all the districts.

- * *Pulicaria vulgaris*. 65, 72, Malvern. Tab. 15. Malvern.
- * *P. dysenterica*. Tab. 15. In all the districts.
- * *Bidens tripartita*. Tab. 15. In all the districts.
- * *B. cernua*. Tab. 15. In all the districts.
- * *Achillea Ptarmica*. Tab. 15. In all the districts.
- * *A. Millefolium*. Tab. 15. In all the districts.
- * *Anthemis arvensis*. 46, Severn D. Tab. 16. In all the districts.
- * *A. Cotula*. Tab. 16. In all the districts.
- * *A. nobilis*. 6, 16, Severn D. Tab. 16. Severn, Malvern.
- * *Matricaria Parthenium*. Tab. 16. In all the districts.
- * *M. inodora*. Tab. 16. In all the districts.
- * *M. Chamomilla*. Tab. 16. In all the districts.
- * *Chrysanthemum Leucanthemum*. Tab. 16. In all the districts.
- * *C. segetum*. Tab. 16. In all the districts.
- * *Artemisia Absinthium*. 124, Hunnington, near Halesowen. Tab. 16. In all the districts.
- * *A. vulgaris*. Tab. 16. In all the districts.
- * *Tanacetum vulgare*. 3, 46, Severn, D. Tab. 16. In all the districts.
- * *Filago germanica*. Tab. 16. In all the districts.
- * *F. apiculata*. 46, near Hartlebury Common, Mr. T. Westcombe. Tab. 16. Severn.
- * *F. minima*. 13, 60, Severn D. ; 66, Malvern. Tab. 16. Severn, Malvern. (*Lickey D.! Probably also Avon*).
- * *Gnaphalium uliginosum*. Tab. 16. In all the districts.
- * *G. sylvaticum*. 6, 9, 13, 18, 46, Severn D. ; 65, Malvern ; 97, Avon. Tab. 16. In all the districts.
- * *G. margaritaceum*. 68, Wyre Forest. Tab. 16. Severn. *Not native*.
- * *Doronicum Pardalianches*. 5, 6, below Winterdyne, Bewdley. Tab. 16. Severn, *Not native*.
- * *Senecio vulgaris, sylvaticus, erucifolius, Jacobæa, aquaticus*. In all the districts.
- S. viscosus*. 95, Badsey, near Evesham, *fide* Purton. Tab. 16. Avon. *Extinct*.
- * *S. squalidus*. 22, 23, walls near Cathedral, Worcester. Tab. 16. Severn. *Not native*.
- * *Carlina vulgaris*, 100, Avon D. Tab. 16. In all the districts.
- * *Arctium majus*. Tab. 16. In all the districts.
- * *A. minus*. Tab. 16. In all the districts.
- * *Serratula tinctoria*. 123, Stour above Halesowen. Tab. 16. In all the districts.
- * *Centaurea nigra*. Tab. 16. In all the districts.
- * *C. Scabiosa*. 46, Severn D. Tab. 16. In all the districts.
- * *C. Cyanus*. 46, Severn D. Tab. 17. Avon, Severn, Malvern. *Not noted in Lickey*.
- * *C. solstitialis*, xxx. Malvern. *Not native*.

- * *Onopordum Acanthium*. 13, 21, 46, Severn D. Tab. 17. In all the districts.
- * *Carduus nutans*. 106, Avon D. Tab. 17. In all the districts.
- * *C. acanthoides, lanceolatus*. Tab. 17. In all the districts.
- * *C. eriophorus*. 47, Severn D.; 68, Malvern; 99, 100, Avon; 133, Dudley.
- * *C. arvensis, palustris*. Tab. 17. In all the districts.
- * *C. pratensis*. 35, Castle Morton; 47, between Tibberton and Crowle; 47, 61, Longdon Marsh; 96, formerly at Feckenham, "Purton;" 98, Alderminster; 119, formerly at Moseley. Tab. 17. In all the districts.
- C. Fosteri*. 47, near Tibberton. Tab. 17. Severn. *First record*.
- * *C. acaulis*, vii. 100, 104, Avon D. Tab. 17. Avon, Severn, Malvern.
(*To be continued.*)

SLUGS AND FROST.

Mr. E. J. Lowe, F.R.S., has communicated to the first number of "The Conchologist" the following observations on this subject:—

"It has been noticed that excessively cold winters, instead of (as generally supposed) destroying slugs, have a contrary effect, and this is very noticeable at the present time. A less frost with mild intervals, inducing the slugs to leave their winter quarters, would be more destructive than a continuous frost.

"When the late frost commenced, the slugs congregated under leaves (good resisters of cold), but as the severity increased they disappeared, descending deeper and deeper into worm holes, &c., where they would find a warmer temperature; but, now the frost has ceased, they are again on the surface, apparently with no diminution in their numbers.

"The following records bearing on this subject will be instructive. In the frost of 1860-61, and again in that of 1879-80, some experiments were made as regards the amount of frost sufficient to kill slugs. &c. These may be briefly stated. A bell-glass was placed on a slate, under which were *Arion ater*, *Limax flavus*, *L. maximus*, *L. agrestis*, and *Amalia marginata*. When the temperature fell to 14° the slugs were frozen and stiff, and not one recovered, so that 18° of frost is enough to destroy their lives. *Helix aspersa*, under another glass, survived; it, like other non-operculated slugs, had a covering of a light layer of mucus (impregnated with calcareous salts), which had the power of resisting many degrees of frost, for as salt water requires a greater degree of cold to freeze it than fresh water, no doubt this layer of mucus was a sufficient protection. The common gnat (*Culex pipiens*),

and larva of the weevil (*Curculis sulcatus*) were similarly treated, and when the temperature fell to 20° (12° of frost), the gnats fell dead, and the weevil larva became frozen and perished.

“Frost will, with difficulty, penetrate organic soil and decomposing leaves. At Highfield House, near Nottingham, in the great frost of 1860-61, when the temperature fell to 8° below zero at four feet above the ground and to 13·8° below zero on the grass—a drain, cut through a bed of organic soil (mainly composed of nut branches) had a temperature four inches below the surface of 42° above zero, *i.e.*, 55·8° higher than on the grass at a few yards’ distance. Although the River Trent was frozen, this drain, only one foot wide, and containing less than twelve inches (in depth) of water, remained unfrozen, the heat of this ancient bed of organic matter keeping off frost. Here *Limax lævis* was found under pieces of wood, regardless of the great cold.”

THE FUNGI OF WARWICKSHIRE.

BY W. B. GROVE, M.A., AND J. E. BAGNALL, A.L.S.

(Continued from page 117.)

- 540.* **P. betulinus**, *Fr.* (Not *Boletus betulinus*, With.) On birch trees. Coleshill Heath; near Arley; [also on a dead but standing birch in the Church Fields, Harborne.]
541. **P. applanatus**, *Fr.* Trunks. Rare. Hopsford, *Adams*.
542. **P. fomentarius**, *Fr.* *Boletus*, *Purt.* On tree trunks. On a stump opposite Alcester Mill; and on the trunk of an elm tree near to Hertford Bridge, *Purt.* ii. 674. Warwick, *Russell*, *Illustr.* Kingswood, *Hawkes!* Salford Priors; Egbaston Park. A peculiar abnormal form of this occurred on some old timber in a manufactory yard in Birmingham.
543. **P. igniarius**, *Fr.* On willow and plum trees, &c. On an old plum tree, Abbey End, Kenilworth, *Russell*, *Illustr.* Ansty, *Adams*. Barston; Packington Park.
544. **P. conchatus**, *Fr.* On tree trunks. Near Coleshill, 1882.
545. **P. ribis**, *Fr.* At the base of currant bushes. Warwick, *Perceval*, September, 1872. Foot of a currant bush, Warwick, July, 1872, *Russell*, *Illustr.*
554. **P. vitreus**, *Fr.* On a cellar wall, Edgbaston, September, 1889, *J. W. Oliver!*

* Nos. 540-545 were accidentally omitted from their numerical order.

555. *P. obducens*, *Pers.* On dead wood, Driffold Lane, Sutton, October, 1887. [The same species on an old hawthorn near Harborne, November, 1883.]
556. *P. vulgaris*, *Fr.* On dead wood, &c. Warwick, *Perceval*. Ansty, *Adams*! Driffold Lane, Sutton.
557. *P. molluscus*, *Fr.* On dead wood. Driffold Lane, Sutton; Coleshill Pool.
558. *P. sanguinolentus*, *Fr.* On rotten wood. Driffold Lane, Sutton, Sutton Park.
559. *P. vaporarius*, *Fr.* In woods, on fallen branches. Near Warwick, *Perceval*. Warwick! *Russell*, *List.* Driffold Lane; Sutton Park; Packington Park; Olton Reservoir; Solihull; Kingsbury, &c.
560. *P. Ptychogaster*, *Ludwig.* The so-called conidial form of this (*Ptychogaster albus*, *Corda*) occurs almost every year on stumps of Scotch fir in Holly Hurst, Sutton Park.

Genus XX. TRAMETES. *Fr.*

561. *T. Bulliardi*, *Fr.* *Boletus suaveolens*, *Purt.* On decaying willows. Rare. Autumn. At Salford, between Mr. Penrice's and Cleve Mill, *Purt.* ii. 669. From Purton's description his plant was probably *T. Bulliardi* and not *T. suaveolens*.
562. *T. suaveolens*, *Fr.* On willow trunks. Bradnock's Marsh, February, 1884.
563. *T. gibbosa*, *Fr.* *Dædalea*, *Purt.* Posts and trunks. June to December. On the side of a footbridge at Great Alne, *Purt.* iii. 248. Bentley Park, *Bloxam*. Sutton Park; on fallen trees, near Baginton Hall; Rotton Park Reservoir.
564. *T. serpens*, *Fr.* *Polyporus Stephensii*, *S. et Sm.*, t. 45, f. 8-12. On an old paling, near Windley Pool, Sutton.

Genus XXI. DÆDALEA. *Pers.*

565. *D. quercina*, *Pers.* *Agaricus*, *Purt.* On oak stumps. Ragley Park; Coughton Bridge; Great Alne, *Purt.* ii, 661. On oaks, The Spring, Kenilworth, *Russell*, *Illustr.* Warwick, April, 1872, *Perceval*. Ansty, *Adams*. Castle Bromwich; Powell's Pool, Sutton Park, *Hawkes*!
566. *D. confragosa*, *Pers.* On stump, Windley Pool, Sutton, November, 1884; exactly *Bolton*, t. 160.
567. *D. unicolor*, *Fr.* On stumps, &c. Near Weddington, *Bloxam*.

Genus XXII. MERULIUS. *Fr.*

568. *M. corium*, *Fr.* On dead trunks. Near Warwick, February, 1872, *Perceval*. Kenilworth, *Russell*, *List*.
569. *M. lachrymans*, *Fr.* *Boletus*, *Purt.* In cellars, &c. In the Rev. W. Bree's cellar at Allesley, October, 1820, *Purt.* iii. 245. Birmingham, *S. Wilkins*! Driffold Lane; Aston, &c.

Genus XXIII. SOLENIA. *Hoffm.*

570. *S. anomala*, *Pers.* On dead wood. October to May. Driffold Lane, Sutton; Shustoke. This species, which abounds in the former locality, is certainly not *S. ochracea*, *Hoffm.*, if the two are really distinct. It forms extensive patches, sometimes 10 to 12 inches long, of closely packed fawn-coloured tubes, growing always on the sawn surfaces of planks or logs. A stipitate form, having a cylindrical stem $1\frac{1}{2}$ to 2 mm. long, and apparently undistinguishable from *S. stipitata*, *Fckl.* (*Sym. Myc. Nachtr.* i. 290), occurred at Sutton, December, 1884.

ORD. III.—HYDNEI.

Genus XXIV. HYDNUM. *Linn.*

571. *H. repandum*, *Linn.* On the ground, in woods. October. Wetheley Wood; Oversley Wood, *Purt.* ii. 677. Burton Green Wood, Kenilworth, *Russell*, *Illustr.* Combe Ridings, *Adams*. Baddesley Park, *Hawkes*! Coleshill Pool, abundant; Shawberries Wood, Shustoke; Princethorpe Wood.
572. *H. scrobiculatum*, *Fr.* Woods. Rare. Alveston Pastures, near Stratford-upon-Avon.
573. *H. auriscalpium*, *Linn.* On fir cones, The Grounds, Hampton-in-Arden, January, 1883; Driffold Lane, Sutton, May, 1889.
574. *H. coralloides*, *Scop.* On ash trees. Rare. At Oversley, in several places, generally on the ash, October, 1813, *Purt.* ii. 676.
575. *H. membranaceum*, *Bull.* Coleshill, *Bree* in *Purt.* ii. 677.
576. *H. ferruginosum*, *Fr.* On dead wood. In Driffold Lane, Sutton, November, 1883.
577. *H. udum*, *Fr.* On rotting wood. In a very damp place, Driffold Lane, Sutton; [also at Barnt Green Reservoir.]
578. *H. niveum*, *Pers.* Dead wood, &c. Rare. Sutton; Trickley Coppice.
579. *H. farinaceum*, *Pers.* On decayed wood. Rare. Sutton; Bradnock's Marsh.

Genus XXV. PHLEBIA. *Fr.*

580. *P. merismoides*, *Fr.* Old stumps and logs. Rare. Near Ansty, *Adams*! Sutton; Olton Reservoir.

Var. *albo-marginata*, *Phillips*. Sutton, on bark. December-January. Differing from the type in the beautiful white byssoid border.

Genus XXVI. GRANDINIA. *Fr.*

581. *G. granulosa*, *Fr.* On fallen branches. October. Crackley Wood, Kenilworth! *Dr. Cooke*. [*Kneiffia setigera*, *Fr.*, grows on a living beech in the Lightwoods, Edgbaston, just beyond the Warwickshire border.]

ORD. IV.—THELEPHOREI.

Genus XXVII. CRATERELLUS. *Fr.*

582. *C. lutescens*, *Fr.* Woods. Rare. Bentley Wood, near Atherstone, *Bloxam*.

583. *C. cornucopioides*, *Fr.* *Peziza*, *Purt.* Woods. Rare. August to October. Oversley Wood, *Purt.* ii. 690. Stoneleigh, *Percival*. Crackley Wood, Kenilworth, *Russell*, *Illustr.* New Park; Shawberries Wood, Shustoke.

Genus XXVIII. THELEPHORA. *Ehrh.*

584. *T. anthocephala*, *Fr.* *Clavaria*, *Purt.* Plantation at Arrow, on a stump, *Purt.* ii. 697.

585. *T. terrestris*, *Ehrh.* On the ground. Rare. Ladies' Hill Wood, Kenilworth, *Russell*, *Illustr.*

586. *T. laciniata*, *Pers.* Castle Bromwich, *Hawkes*! Sutton Park, creeping over stones, sticks, bushes, &c.; Lower Nut Hurst; Windley Pool; Olton Reservoir.

587. *T. mollissima*, *Pers.* *Auricularia caryophyllea*, *Purt.* Near Allesley, *Bree* in *Purt.* iii., 261.

588. *T. cristata*, *Fr.* *Clavaria laciniata*, *With.*, *Purt.* Edgbaston Plantations, *With.* 359. Oversley Wood; Oversley Lane, *Purt.* ii. 697.

Genus XXIX. STEREUM. *Fr.*

589. *S. purpureum*, *Fr.* *Auricularia persistens*, *Purt.* Stump of a tree near Oversley Mill, *Purt.* ii. 683. The Common, Kenilworth, *Russell*. *Illustr.* Hopsford, *Adams*. Driffold Lane, Sutton; by Hartshill Hayes; Crackley Wood; Coleshill Heath and Pool; Shustoke, Water Orton; Spernall; Edgbaston Park.

590. *S. hirsutum*, *Fr.* On stumps. Common. Warwick, *Perceval*. The Spring, Kenilworth, *Russell*, *Illustr.* Ansty, *Adams*. Sutton; New Park; Shustoke; Hartshill; Marston Green; Packington Park; Coleshill Heath; Edgbaston; Trickle Coppice; Crackley Wood; Spernall, &c.

(To be continued.)

ILLUSTRATIONS OF BRITISH FUNGI.*

This truly valuable work has at length reached its conclusion, having occupied ten years in publication. It was at first intended to have embraced the whole of the Hymenomycetal Fungi, but so many of the subscribers appeared unwilling to support it to its extreme end that Dr. Cooke has wisely decided that the present part, lxxvi., shall conclude the work. As it now stands it occupies eight large octavo volumes, and contains all the gill-bearing Fungi, or *Agaricini*, of Britain. To complete the Hymenomycetes there remain the species of *Boletus*, *Polyporus*, *Hydnum*, the *Thelephorei*, *Tremella*, and *Clavaria*; and these, I understand, would have occupied nearly four additional volumes. The majority of fungologists will concede that the excluded portion is, if anything, more needed than the agarics, because they have not at present been figured to anything like the same extent.

From what I learn, the author is willing to publish these four volumes as a separate work if he can obtain sufficient support to guarantee him from severe loss in the matter, and it is to be sincerely hoped that such support will be forthcoming. Every botanist should do what he can to obtain subscribers.

The volumes under review contain just 1,200 coloured plates, and represent 1,400 species, which is more than one-fourth of the whole number described from all parts of the world. A large part of these have never been figured before, and I am informed that most of the plates in the earlier volumes had the advantage of being submitted to the late Rev. M. J. Berkeley for his opinion and advice, especially such as are critical. The sum fixed as the publishing price of these volumes was most moderate, but the reduction of one-fourth made to subscribers brought them below anything of the kind ever attempted previously. Contemporaneous works on the same subject issued abroad were more than double the price, and much inferior in artistic merit. It may be stated, and without exaggeration, that the present work includes a larger number of species of *Agaricini* than any six of the largest and most comprehensive works previously published, without taking into consideration the number of species of which figures are repeated in the different works.

The plates in the present work offer an advantage which no previous work possessed, in that all the outlines were

* "Illustrations of British Fungi," by M. C. Cooke. Vols. I. to VIII. 8vo. Williams and Norgate.

photographed and transferred to stone from the author's own drawings. All the 1,200 plates were also coloured as patterns by the author, and printed from his patterns, without the intervention of any artist unacquainted with the subject, so that nothing was omitted which could assist in rendering them as fair reproductions as modern chromo-photo-lithography could produce.

A special feature is the great care that has been taken to prevent the plates in these volumes being spoiled by over-colouring, a fault not always absent from some of the best predecessors of the present work.

It is an unfortunate circumstance that high-class scientific works are scarcely ever remunerative, and it is doubtful if any publisher could have been found to undertake the risk of such a book as the "Illustrations." The author took this heavy burden upon himself and contended with it for ten years, at the close of which period, I am sorry to say, he is much out of pocket, while it is needless to add that he has not received any compensation for his many years of persistent labour and anxiety, and for his special knowledge. The support he has received at home, for what is really a national work, cannot have given him much encouragement. There are less than sixty subscribers for the whole of the British Islands. This scarcely indicates much patriotic support, and but for the subscribers which were found in nearly every country of Europe, in the United States, India, and Australia, the work must necessarily have been abandoned, which would have been a very great loss to Science. Such a work as this should surely find a place in every public library in the kingdom, to say nothing of private libraries of any pretensions, to which it would always prove a valuable contribution and illustration of the botanical treasures of the country. As an illustrated botanical work it takes rank with "Sowerby's English Botany," and since Sowerby's time no other work has any claim to such a position.

A suggestion has been made to issue the fifty sets which still remain, in parts, if fifty new subscribers can be found, at the rate of two parts monthly, at the original subscription price of five shillings per part, thus ensuring its complete issue in three years. I hope this suggestion may be carried out, and that it shall no longer remain a stigma on British botanists, that they could permit the author to work ten years for nothing, with a balance against him of nearly one hundred pounds.

J. E. BAGNALL.

Scientific Gleanings.

LORD DERBY has been appointed to be Chancellor of the University of London in the place of Lord Granville, deceased.

MR. WILLIAM LANGDON, in a recent paper read at an ordinary meeting of the Institution of Royal Engineers, advocated electric lighting as the best in all respects for the lighting of railway trains.

THE PHYSICAL SOCIETY OF LONDON held a special meeting at Cambridge on May 9th, at the Cavendish Laboratory. Opportunity was afforded for members to visit the Cavendish and other University Laboratories.

THE ANNUAL MEETING OF THE IRON AND STEEL INSTITUTE began at the Institute of Civil Engineers, in Great George Street, London, on the 6th of May, and continued on the 7th. The autumn meeting of the Institute will most probably be held at Birmingham.

DR. THOMAS DUTTON, in his practical treatise on "Sea Sickness" (Baillière, Tindall, and Cox), states that there is "no absolute specific" for this distressing malady.

THE PHILOSOPHICAL SOCIETY OF BERLIN offers a prize of 1,000 marks for the best essay on the relation of philosophy to the empirical science of nature. The essays may be in German, French, English, or Latin, but must be sent in before April 1st, 1893.

THE CONVERSAZIONE OF THE SOCIETY OF ARTS will be held at the South Kensington Museum on the same evening as that announced for the Ladies' *soirée* of the Royal Society.

THE LADIES' SOIREE OF THE ROYAL SOCIETY is announced for Wednesday, June 17th.

PROFESSOR CARL WILHELM VON NAGELI, the eminent botanist, died at Munich, on the 10th of May, in his 74th year.

AN OLD BIRMINGHAM MAN, the Rev. H. N. Hutchinson, has undertaken to write a manual of physical geology for Messrs. Swan, Sonnenschein, and Co.'s "Introductory Science Text Books."

THE OPENING MEETING of the International Congress of Hygiene and Demography will be held in London on Monday, August 10th, at 3 30, when the Prince of Wales will preside.

A VALUABLE and very interesting book of African travel has been recently issued, "Across East African Glaciers: an Account of the First Ascent of Kilimanjaro" (19,700 feet), by Dr. Hans Meyer. It is well illustrated, and is published by Messrs. George Philip and Son, London.

MESSRS. MACMILLAN AND Co. have just published "Natural Selection and Tropical Nature: Essays on Descriptive and Theoretical Biology," by Mr. A. R. Wallace. The text has been carefully revised and some important additions made.

A VALUABLE BEQUEST has been made to the Department of Science and Art by the late Miss Marshall. In addition to a large number of scientific books and instruments which are left for the use of students, a sum of £1,000 is bequeathed for the founding of scholarships, or for application in any other way that may be considered best for the advancement of biological science.

THE FOURTH SUMMER MEETING of the Oxford University Extension Students will be held at Oxford, and be divided into two parts. The first will commence on Friday, July 31st, and end Tuesday, August 11th. The second part will commence on August 12th, and end on August 31st.

AN ACCOUNT OF THE BIRMINGHAM SCHOOL OF MEDICINE (Queen's College) has recently been published. The authors are Dr. B. C. A. Windle and Professor W. Hillhouse, M.A., F.L.S., &c. Their intention is to show—and this they do effectually—that Birmingham possesses one of the best equipped schools of medicine in the provinces.

MISS ORMEROD has just issued a valuable pamphlet on "Paris Green," an excellent insecticide, which can be relied on to destroy caterpillars on fruit trees, &c., provided it is applied properly. Her pamphlet gives ample instruction on this and all other points about which the fruit grower is likely to require information. The pamphlet can be obtained on application to Miss Ormerod, Torrington House, St. Albans.

SOME RECENT OBSERVATIONS indicate that the catch of fish off the Cornish coast this season is larger than usual. On the 18th March last 12,000 grey mullet were captured at Whitsand Bay, Land's End. On the 31st of March a Lowestoft mackerel driver, fishing some leagues south-west of the Lizard, took 48,000 mackerel. This must have been an extraordinary catch. It is said to have realised £360.

IN A PAPER ON THE HUMBLEBEE IN NEW ZEALAND, published in the revived "New Zealand Journal of Science," the author says, in reference to the question of how far these insects are adapting themselves to new flowers in the colony, that he has noticed them on many species of introduced plants which they usually never visit in Europe. They seldom approach white flowers, and, with the exception of *Fuchsia excorticata* and the Ngaio (*Myoporum laetum*), he has never heard of their visiting indigenous flowers.

AT THE RECENT ANNIVERSARY MEETING (the sixty-second) of the Zoological Society, the following were elected new members of the Council in the place of retiring members:—Mr. William T. Blanford, F.R.S., Dr. Albert Günther, F.R.S., Mr. E. W. N. Holdsworth, Sir Albert K. Rollit, M.P., and Mr. Howard Saunders. Professor Flower, C.B., F.R.S., was re-elected President, Mr. Charles Drummond Treasurer, and Dr. Philip Lutley Sclater, F.R.S., Secretary for the ensuing year. The accounts were very satisfactory. Balance forward, £1,242 13s. 11d.; receipts, £25,059 17s. 10d.; total, £26,302 11s. 9d.; expenditure, £23,572 11s. 5d.

THE GENERAL PROGRAMME FOR THE CARDIFF MEETING of the British Association has now been settled. The first meeting will be held on Wednesday, August 19, at 8 p.m., when Sir F. Abel, K.C.B., will resign the chair to the President elect, Dr. William Huggins, who will deliver an address. The following evening there will be a *soirée* at 8 p.m. On Friday, August 21, at 8 30, Professor L. C. Miall will deliver an address on "Some Difficulties in the Life of Aquatic Insects." On Monday, August 24, at 8 30 p.m., there will be a discourse by Professor T. E. Thorpe, F.R.S.; the following evening, at 8, there will be a *soirée*. The concluding general meeting will take place on Wednesday, August 26, at 2 30 p.m.

SIR W. HART DYKE said recently, in the House of Commons, that of the fifty County Councils and sixty County Boroughs in England sixteen of the former and twenty-five of the latter had already decided to apply the whole of their share of the residue under the Local Taxation (Customs and Excise) Act of 1890 to science and art and technical education. Nine County Councils and two County Boroughs had made grants, varying from "nearly the whole" to a smaller proportion of their share to the same purpose. Twelve County Councils and seven County Boroughs had the matter under consideration; that is to say, they had appointed committees, and in many cases the committees had recommended the allocation of the whole, or the greater part, of the residue of the fund for technical instruction, but their reports had not yet been confirmed by the County or Borough Councils.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—MICROSCOPICAL SECTION, May 5th. Mr. C. Pumphrey (President) in the chair. Mr. Pumphrey exhibited a Hawfinch (*Coccothraustes vulgaris*) that had killed itself by flying against one of his windows; and a fine series of a dozen preparations of insects' eggs, with a few parasites of birds. Mr. A. Reading exhibited a larger series, chiefly of bird parasites. In both cases the exhibitors gave a short but clear account of the objects shown.—BIOLOGICAL SECTION, May 12th. Mr. R. W. Chase in the chair. Mr. R. W. Chase read a paper on "The Columbidae occurring in Britain," which he illustrated by specimens of each species. A keen discussion followed, in which several members took part. A vote of thanks to Mr. Chase, terminated the meeting.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—April 20th. Exhibition of Polarised Objects. Mr. J. W. Neville showed elytra of *Dytiscus marginalis* and other beetles, remarking that the crosses seen in these objects by polarised light were caused by chitinous tubercles and not by calcareous discs, as some had supposed; Mr. H. Hawkes, twenty-four starches of various kinds, with remarks on their structure; Mr. J. Moore, specimens of cocoa and mustard, showing the extent of their adulteration with starch, one sample of so-called pure mustard showed more starch grains than others sold as not pure.—April 27th. Mr. W. Dunn read a paper on "Dust." The writer said he did not purpose dealing with the germ theory, but rather with the subject generally. His attention was first drawn to it by the injurious effects of metallic dust used in some industries. This led to a number of experiments, resulting in a simple contrivance that rendered the workshop free from any deleterious particles floating in the air. The workman occupied a small apartment partitioned off and tapering to an outside wall, in which a fan rapidly revolved, drawing all dust from the workman. In the glass trade this freed the operatives from a liability of lead poisoning. The writer then referred to dust generally—its origin,

constituents, and effects on the body. A discussion closed the meeting.—May 4th. Mr. J. Madison showed two specimens of *Planorbis corneus*, from Stirchley; the older part of the shell was of the normal colour, but the last year's growth was white. Mr. Madison also presented some photographs to the society's album; they comprised views of the "Devil's Chimney" and other rock scenery of the Leckhampton district.—May 11th. Special—Geology. Mr. J. W. Neville gave an account of the society's excursion to Linley Caverns, Daw End, and showed specimens of the fossils collected there. Mr. J. Madison exhibited a specimen of trilobite from the same place; Mr. J. Collins, a case of fossils from the Jurassic and Miocene formations; Mr. P. T. Deakin, sharks' teeth from the Red Crag, Suffolk, and a series of specimens of *Chama squamosa* and other shells from Barton Cliff; Mr. Linton, three eggs from a blackbird's nest, showing marked variation in colour; Mr. J. Moore, section of mountain limestone with foraminifera *in situ*.

OXFORD NATURAL HISTORY SOCIETY.—May 7th. The President (Professor A. H. Green) in the chair. Lecture by Mr. H. Boswell, M.A., on the "Life History of a Moss." The lecturer briefly traced the structure and development of mosses, illustrating the different stages of their growth by reference to some excellent diagrams. He also showed dried specimens of *Hypnum stellatum* and a few others which are now rare in this neighbourhood.—May 21st. Paper by Mr. A. Sidgwick, M.A., on the "Rarity of Insects." The lecturer dealt chiefly with the Hawk Moths, taking as the simplest case of rarity those insects which come over and breed in this country. He gave the different numbers which appeared each year (from 1846 to 1890), and the localities in which they were found, remarking that in the year 1846, when great numbers of *D. Euphorbiæ* were captured, they were not to be taken as a proof of permanence, but due to excessive heat. He gave three chief causes which contributed to the scarcity, viz.:—Failure of food, attacks of parasites, and effects of climate. With regard to the first of these, if the food-plant of a moth confined to a special locality were artificially destroyed the insect would disappear from that neighbourhood, as in the case of the Large Copper, by the draining of the fens. Mr. E. B. Poulton had given an interesting example of this, in an account of a very rare Clear-wing which fed on docks in the neighbourhood of Dover. The docks were all dug up, and it subsisted for some time on sorrel, but became much reduced in size, and finally disappeared. Speaking of the effects of climate, the lecturer remarked that in the egg stage the insect is comparatively safe, because it is firmly fixed to the leaf on which it is to feed when hatched. A thunderstorm will, however, sometimes make some species rare in a neighbourhood. East winds, frosty nights, and too much rain are all injurious. In the chrysalis stage it resists frost and flood. An interesting discussion followed, in which the late President (Mr. E. B. Poulton) and Colonel Swinhoe took part; after which specimens of a few rare moths were exhibited, including one of the Clear-wing fed on docks, and one of the reduced size, fed on sorrel.—Mr. H. M. J. Underhill then read a paper on "Painting Lantern Slides." He commenced by illustrating on the screen the different colours used, and some unfinished slides, showing the actual working. He then described various ways of smoothing, tinting, making different ground colours, &c., together with some other improvements he had devised. Some slides of animalcules, in rich shaded blue on a black ground, were much admired.

ANIMAL PEDIGREES.*

BY A. MILNES MARSHALL, M.A., M.D., D.SC., F.R.S.,
BEYER PROFESSOR OF ZOOLOGY IN OWENS COLLEGE, MANCHESTER.

(Continued from page 129.)

We must now turn to another side of the question. Although it is undoubtedly true that development is to be regarded as a recapitulation of ancestral phases, and that the embryonic history of an animal presents to us a record of the race history ; yet it is also an undoubted fact, recognised by all writers on embryology, that the record so obtained is neither a complete nor a straightforward one.

It is indeed a history, but a history of which entire chapters are lost, while in those that remain many pages are misplaced and others are so blurred as to be illegible ; words, sentences, or entire paragraphs are omitted, and, worse still, alterations or spurious additions have been freely introduced by later hands, and at times so cunningly as to defy detection.

Very slight consideration will show that development cannot in all cases be strictly a recapitulation of ancestral stages. It is well known that closely allied animals may differ markedly in their mode of development. The common frog is at first a tadpole, breathing by gills, a stage which is entirely omitted by the West Indian *Hylodes*. A crayfish, a lobster, and a prawn are allied animals, yet they leave the egg in totally different forms. Some developmental stages, as the pupa condition of insects, or the stage in the development of a dogfish in which the œsophagus is imperforate, cannot possibly be ancestral stages. Or again, a chick embryo

* OWENS COLLEGE,
June 15th, 1891.

To the Editor of the "Midland Naturalist."

Sir,—Kindly allow me to correct an error in the part of my paper on "Animal Pedigrees" that appeared in the June number of the "Midland Naturalist."

I quoted, as examples of rudiments, the silent letters in certain words ; and amongst these is given, on page 124, the letter *g* of the word "foreign." The word I wrote, or intended to write, was "reign," in which the *g*, now mute and rudimentary, is traceable by direct descent from the *g* of the Latin *regnum*.

The *g* of "foreign" is not a rudiment : how it got into the word I must leave the etymologists to explain, but it is most certainly an acquired and not an ancestral character.

It is a good illustration of the difficulties with which a morphologist is constantly confronted that in two words so similar in appearance the exceptional letter should have such totally different histories.

Yours, &c.,

A. MILNES MARSHALL.

of say the fourth day, is clearly not an animal capable of independent existence, and therefore cannot correctly represent any ancestral condition, an objection which applies to the developmental history of many, perhaps of most, animals.

Haeckel long ago urged the necessity of distinguishing, in actual development, between those characters which are really historical and inherited, and those which are acquired or spurious additions to the record. The former he termed palingenetic or ancestral characters, the latter cenogenetic or acquired. The distinction is undoubtedly a true one, but an exceedingly difficult one to draw in practice. The causes which prevent development from being a strict recapitulation of ancestral characters, the mode in which these came about, and the influence which they respectively exert, are matters which are greatly exercising embryologists; and the attempt to determine them has as yet met with only partial success.

The most potent and the most widely spread of these disturbing causes arise from the necessity of supplying the embryo with nutriment. This acts in two ways. If the amount of nutritive matter within the egg is small, then the young animal must hatch early, and in a condition in which it is able to obtain food for itself. In such cases there is of necessity a long period of larval life, during which natural selection may act so as to introduce modifications of the ancestral history, spurious additions to the text.

If, on the other hand, the egg contain within itself a considerable quantity of nutrient matter, then the period of hatching can be postponed until this nutrient matter has been used up. The consequence is that the embryo hatches at a much later stage of its development, and if the amount of food material is sufficient may even leave the egg in the form of the parent. In such cases the earlier developmental phases are often greatly condensed and abbreviated; and as the embryo does not lead a free existence, and has no need to exert itself to obtain food, it commonly happens that these stages are passed through in a very modified form, the embryo being, as in a four-day chick, in a condition in which it is clearly incapable of independent existence.

The nutrition of the embryo prior to hatching is most usually effected by granules of nutrient matter, known as food yolk, and embedded in the protoplasm of the egg itself; and it is on the relative abundance of these granules that the size of the egg chiefly depends.

Large size of eggs implies diminution of the number of the eggs, and hence of the offspring; and it can be well understood that while some species derive advantage in the

struggle for existence by producing the maximum number of young, to others it is of greater importance that the young on hatching should be of considerable size and strength, and so better able to begin the world on their own account. In other words, some animals may gain by producing a large number of small eggs, others by producing a smaller number of eggs of larger size—*i.e.*, provided with more food yolk.

The immediate effect of a large amount of food yolk is to mechanically retard the processes of development; the ultimate result is to greatly shorten the time occupied by development. This apparent paradox is readily explained. A small egg, such as that of *Amphioxus*, starts its development rapidly, and in about eighteen hours gives rise to a free swimming larva, capable of independent existence, with a digestive cavity and nervous system already formed; while a large egg, like that of the hen, hampered by the great mass of food yolk with which it is distended, has, in the same time, made but very slight progress.

From this time, however, other considerations begin to tell. *Amphioxus* has been able to make this rapid start owing to its relative freedom from food yolk. This freedom now becomes a retarding influence, for the larva, containing within itself but a very scanty supply of nutriment, must devote much of its energies to hunting for, and to digesting its food, and hence its further development will proceed more slowly.

The chick embryo, on the other hand, has an abundant supply of food in the egg itself; it has no occasion to spend time searching for food, but can devote its whole energies to the further stages of its development. Hence, except in the earliest stages, the chick develops more rapidly than *Amphioxus*, and attains its adult form in a much shorter time.

The tendency of abundant food yolk to lead to shortening or abbreviation of the ancestral history, and even to the entire omission of important stages, is well known. The embryo of forms well provided with yolk takes short cuts in its development, jumps from branch to branch of its genealogical tree, instead of climbing steadily upwards.

An excellent illustration of the influence of food yolk on development is afforded by the life histories of frogs. The common frog, *Rana temporaria*, lays, as is well known, eggs of small size, about $\frac{1}{16}$ inch in diameter. A small egg can only contain a limited amount of food yolk, and hence the young frog can only accomplish a small part of its developmental history within the egg, and must then hatch in order to obtain food from without. Consequently, a frog hatches not as a frog but as a tadpole, *i.e.*, at the fish stage in the

ancestral history of frogs. At the time of hatching, Fig. 16, there are no limbs and no lungs; the heart, the alimentary canal, and the nervous system are in an extremely imperfect condition; while other organs of the adult frog, such as the kidneys, have not yet commenced to appear. The frog has, therefore, to effect the greater part of its development after the time of hatching.

In the little West Indian frog, *Hylodes*, Fig. 22, the course of events is very different. This frog, which is of small size—less than a couple of inches in length—lays its eggs not in water but on the leaves of plants. The eggs are large, having a diameter of about $\frac{1}{5}$ inch, *i.e.*, are about three times the diameter and twenty-seven times the bulk of the eggs of the common English frog; compare Figs. 15 and 19, which are drawn to the same scale. The large size of the egg is caused, as we have seen, by great abundance of food yolk; and the consequence of this large supply of food yolk in the egg of *Hylodes* is that the frog is enabled to complete the whole of its development before hatching, and emerges from the egg capsule, Fig. 21, in a form differing from the adult merely in the possession of a rudimentary stump of a tail; and even this disappears before the close of the first day of its existence, Fig. 22.

A further and direct consequence of this development within the egg is that the successive stages are hurried over, and are at best but imperfectly recapitulated. Thus, although *Hylodes* passes through what may be called a tadpole stage, Fig. 19, yet it never develops gills; so that were *Hylodes* the only frog known to us, it is very likely that we should have arrived at wrong conclusions concerning the pedigree of frogs.

The influence of food yolk on the development of animals is closely analogous to that of capital in human undertakings. A new industry, for example that of pen-making, has often been started by a man working by hand and alone, making and selling his own wares; if he succeed in the struggle for existence, it soon becomes necessary for him to call in others to assist him, and to subdivide the work; hand labour is soon superseded by machines, involving further differentiation of labour; the earlier machines are replaced by more perfect and more costly ones; factories are built, agents engaged, and, in the end, a whole army of workpeople employed. In later times a man commencing the same business with very limited means will start at the same level as the original founder, and will have to work his way upwards through much the same stages, *i.e.*, will repeat the pedigree of the industry.

The capitalist, on the other hand, is enabled, like Hylodes, to omit these earlier stages, and, after a brief period of incubation, to start business with large factories equipped with the most recent appliances, and with a complete staff of work-people, *i.e.*, to spring into existence fully fledged.

There is no doubt that abundance of food yolk is a direct and very frequent cause of the omission of ancestral stages from individual development; but it must not be viewed as a sole cause. It is quite impossible that any animal, except perhaps in the lowest zoological groups, should repeat all the ancestral stages in the history of the race; the limits of time available for individual development will not permit this. There is a tendency in all animals towards condensation of the ancestral history, towards striking a direct path from the egg to the adult.

This tendency is best marked in the higher, the more complicated members of a group, *i.e.*, in those which have a longer and more tortuous pedigree; and although greatly strengthened by the presence of food yolk in the egg, is apparently not due to this in the first instance.

Thus the simpler forms of Orbitolites, as *O. tenuissima*, repeat in their development all the stages leading from a spiral to a discoidal shell; but in the more complicated species, as Dr. Carpenter has pointed out, there is a tendency towards precocious development of the adult characters, the earlier stages being hurried over in a modified form; while in the most complex examples, as in *O. complanata*, the earlier spiral stages may be entirely omitted, the shell acquiring almost from its earliest commencement the discoidal mode of growth. There is no question here of relative abundance of food yolk, but merely of early or precocious appearance of adult characters.

Of causes other than food yolk, or only indirectly connected with it, which tend to falsify the ancestral history, many are now known, but time will only permit me to notice the more important. These are distortion, whether in time or space; sudden or violent metamorphosis; a series of modifications, due chiefly to mechanical causes, and which may be spoken of as developmental conveniences; the important question of variability in development; and finally the great problem of degeneration.

Concerning distortion in time, all embryologists have noticed the tendency to anticipation or precocious development of characters which really belong to a later stage in the pedigree. The early attainment of the discoidal form in the shell of *Orbitolites complanata* is a case in point; and Würten-

berger has specially noticed this tendency in Ammonites. Many early larvæ show it markedly, the explanation in this case being that it is essential for them to hatch in a condition capable of independent existence, *i.e.*, capable, at any rate, of obtaining and digesting their own food.

Anachronisms, or actual reversal of the historical order of development of organs or parts, occur frequently. Thus the joint surfaces of bones acquire their characteristic curvatures before movement of one part on another is effected, and before even the joint cavities are formed.

Another good example is afforded by the development of the mesenterial filaments in Alcyonarians. Wilson has shown in the case of *Renilla* that in the development of an embryo from the egg the six endodermal filaments appear first, and the two long ectodermal filaments at a later period; but that in the formation of a bud this order of development is reversed, the ectodermal filaments being the first formed. He suggests, in explanation, that as the endodermal filaments are the digestive organs, it is of primary importance to the free embryo that they should be formed quickly. The long ectodermal filaments are chiefly concerned with maintaining currents of water through the colony; in bud-development they appear before the endodermal filaments, because they enable the bud during its early stages to draw nutrient matter from the body fluid of the parent; while the endodermal filaments cannot come into use until the bud has acquired its own mouth and tentacles.

The completion of the ventricular septum in the heart of higher vertebrates before the auricular septum is an often quoted anachronism, and every embryologist could readily furnish many other cases.

A curious instance is afforded by the development of the teeth in mammals, if recent suggestions as to the origin of the milk dentition are confirmed, and the milk dentition prove to be a more recent acquisition than the permanent one.

Distortion of a curious kind is seen in cases of abrupt metamorphosis, where, as in the case of many Echinoderms, of Phoronis, and of the metabolic insects, the larva and the adult differ greatly in form, habits, mode of life, and very usually in the nature of their food and the mode of obtaining it; and the transition from the one stage to the other is not a gradual but an abrupt one, at any rate so far as external characters are concerned.

Sudden changes of this kind, as from the free swimming *Pluteus* to the creeping *Echinus*, or from the sluggish leaf-eating caterpillar to the dainty butterfly, cannot possibly be

recapitulatory, for even if small jumps are permissible in nature, there is no room for bounds forward of this magnitude. Cases of abrupt metamorphosis may always be viewed as due to secondary modifications, and rarely, if ever, have any significance beyond the particular group of animals concerned. For example, a *Pluteus* larva may be recognised as belonging to the group of Echinoidea before the adult urchin has commenced to be formed within it, and the Lepidopteran caterpillar is already an unmistakable insect. Hence, for the explanation of the metamorphoses in these cases it is useless to look outside the groups of Echinoidea and Insecta respectively.

Abrupt metamorphosis is always associated with great change in external form and appearance, and in mode of life, and very usually in mode of nutrition. A gradual transition in such cases is inadmissible, because in the intermediate stages the animal would be adapted to neither the larval nor the adult condition; a gradual conversion of the biting mouth parts of the caterpillar to the sucking proboscis of a moth would inevitably lead to starvation. The difficulty is evaded by retaining the external form and habits of one particular stage for an unduly long period, so that the relations of the animal to the surrounding environment remain unchanged, while internally preparations for the later stages are in progress.

Cinderella and the princess are equally possible entities, each being well adapted to her environment. The exigencies of the situation do not permit, however, of a gradual change from one to the other: the transformation, at least as regards external appearance, must be abrupt.

Embryology supplies us with many unsolved problems, and it is not to be wondered at that this should be the case. Some of these may fairly be spoken of as mere curiosities of development, while others are clearly of greater moment. I do not propose to catalogue these, but will merely mention one which I happen to have recently run my head against, and remember vividly.

The solid condition of the œsophagus in dogfish embryos, first noticed by Balfour, is a very curious point. The œsophagus has at first a well-developed lumen, like the rest of the alimentary canal; but at an early period, stage K of Balfour's nomenclature, the part of the œsophagus overlying the heart, and immediately behind the branchial region, becomes solid, and remains solid for a long time, the exact date of reappearance of the lumen not being yet ascertained.

A similar solidification of the œsophagus occurs in tadpoles of the common frog. In young free swimming tadpoles the œsophagus is perforate, but in tadpoles of about $\frac{1}{3}$ inch

length it becomes solid and remains so until a length of about $\frac{1}{2}$ inch has been attained. The solidification occurs at a stage closely corresponding with that in which it first appears in the dogfish, and a curious point about it is that in the frog the œsophagus becomes solid just before the mouth opening is formed, and remains solid for some little time after this important event.

This closing of the œsophagus clearly cannot be recapitulation, but the fact that it occurs at corresponding periods in the frog and the dogfish suggests that it may possibly, as Balfour hinted, "turn out to have some unsuspected morphological bearing."

A matter which at present is attracting much attention is the question of degeneration.

Natural selection, though consistent with and capable of leading to steady upward progress and improvement, by no means involves such progress as a necessary consequence. All it says is that those animals will, in each generation, have the best chance of survival which are most in harmony with their environment, and such animals will not necessarily be those which are ideally the best or most perfect.

If you go into a shop to purchase an umbrella the one you select is by no means necessarily that which most nearly approaches ideal perfection, but the one which best hits off the mean between your idea of what an umbrella should be and the amount of money you are prepared to give for it; the one, in fact, that is on the whole best suited to the circumstances of the case, or the environment for the time being. It might well happen that you had a violent antipathy to a crooked handle, or else were determined to have a catch of a particular kind to secure the ribs, and this might lead to the selection, *i.e.*, the survival, of an article that in other and even in more important respects was manifestly inferior to the average.

So is it also with animals: the survival of a form that is ideally inferior is very possible. To animals living in profound darkness the possession of eyes is of no advantage, and forms devoid of eyes would not merely lose nothing thereby, but would actually gain, inasmuch as they would escape the dangers that might arise from injury to a delicate and complicated organ. In extreme cases, as in animals leading a parasitic existence, the conditions of life may be such as to render locomotor, digestive, sensory, and other organs entirely useless; and in such cases those forms will be most in harmony with their surroundings which avoid the waste of energy resulting from the formation and maintenance of these organs.

(To be continued.)

FORAMINIFERA OF HAMMERFEST, NORWAY.*

BY E. W. BURGESS.

In 1889 a sample was given me by Messrs. Marshall and Pumphrey of mud from the bottom of Hammerfest Harbour, Norway, which they had gathered the year before off the anchor of the North Cape steamer on leaving the harbour. I have examined this material for Foraminifera, and found fifty-one species in it, several of which are very rare ; and have prepared a slide of the different species contained, which is now presented to the Society, with the following remarks upon the several specimens, in continuation of the report on "Foraminifera of Oban" that was given to the Society at a former meeting ("Midland Naturalist," 1889, pp. 77, 116, 130).

References are given, principally to the undermentioned works, and to avoid lengthy repetitions the name of the author and date only are repeated in each case:—

Williamson, C. W., Recent Foraminifera, Gt. Britain (Ray Soc.), 1858 (R. F.)

Brady, H. B., Challenger Report, Vol. IX., text, and plates, 1884 (C. R.)

To Professor Rupert Jones and Mr. C. D. Sherborn my thanks are due for assistance in examining a few of the rarest forms of the gathering.

DESCRIPTION OF THE SPECIMENS.

1. *Biloculina depressa*. D'Orbigny, 1826.

Williamson (R. F.), 1858, p. 79, pl. vii., figs. 172-174.

Brady (C. R.), 1884, p. 45, pl. ii., figs. 12, 15-17 ; pl. iii., figs. 1, 2.

Great variations are to be found in the amount of compression this form is subject to. Common.

2. *Miliolina oblonga*. Montagu, 1803.

Williamson (R. F.), 1858, p. 84, pl. vii., figs. 186, 187.

Brady (C. R.), 1884, p. 160, pl. v., figs. 4, *a*, *b*. Rare.

3. *Miliolina trigonula*. Lamarck, 1804.

Williamson (R. F.), 1858, p. 84, pl. vii., figs. 180, 182.

Brady (C. R.), 1884, p. 164, pl. iii., figs. 14-16.

It is difficult at times to separate this form from *Miliolina tricarinata*, as the separation is by means of either the sharpness or roundness of the angles, that of *M. tricarinata* running into a keeled angle. Common.

* Read before the Birmingham Natural History and Microscopical Society, May 6th, 1890.

4. *Miliolina seminulum*. Linne, 1767 ?
Williamson (R. F.), 1858, p. 85, pl. vii., figs. 183, 185.
Brady (C. R.), 1884, p. 157, pl. v., figs. 6, *a*, *b*, *c*.
Rather rare.
5. *Miliolina subrotunda*. Montagu, 1803.
Balkwill and Wright (J. F.), 1885, p. 324, pl. xii.,
figs. 8, 9.
Brady (C. R.), 1884, p. 168, pl. v., figs. 10, 11.
Frequent.
6. *Miliolina venusta*. Kar, 1868.
Brady (C. R.), 1884, p. 162, pl. v., figs. 5, 7. Rare.
7. *Reophax scorpiurus*. Montfort, 1808.
Balkwill and Wright (J. F.), 1885, p. 328, pl. xiii.,
figs. 5A, 5B.
Brady (C. R.), 1884, p. 291, pl. xxx., figs. 12-17.
Frequent.
8. *Haplophragmium canariense*. D'Orbigny, 1839.
Williamson (R. F.), 1858, p. 34, pl. iii., figs. 72, 73.
Brady (C. R.), 1884, p. 310, pl. xxxv., figs. 1-5.
Common.
9. *Haplophragmium glomeratum*. Brady, 1878.
Brady, Ann. and Mag. Nat. Hist., 1878, p. 433,
pl. xx., figs. 1 *a*, *b*, *c*.
Brady (C. R.), 1884, p. 309, pl. xxxiv., figs. 15-18.
Rare.
10. *Bulimina pupoides*. D'Orbigny, 1846.
Williamson (R. F.), 1858, p. 62, pl. v., figs. 124, 125.
Brady (C. R.), 1884, p. 400, pl. l., figs. 15, *a*, *b*.
Very common.
11. *Bulimina aculeata*. D'Orbigny, 1826.
Williamson (R. F.), 1858, p. 62, pl. v., fig. 128.
Brady (C. R.), p. 406, pl. li., figs. 7-9. Rare.
12. *Bulimina marginata*. D'Orbigny, 1826.
Williamson (R. F.), 1858, p. 62, pl. v., figs. 126, 127.
Brady (C. R.), 1884, p. 405, pl. li., figs. 3-5.
Common.
13. *Bulimina ovata*. D'Orbigny, 1846.
Brady (C. R.), 1884, p. 400, pl. l., figs. 13, *a*, *b*.
H. B. Brady remarks: "*Bulimina pupoides* and *B.*
ovata cannot be separated except by comparative
characters too variable to be of any real
zoological value." Rare.
14. *Virgulina schreibersiana*. Czjzek, 1847.
Williamson (R. F.), 1858, p. 63, pl. v., fig. 131.
Brady (C. R.), 1884, p. 414, pl. lii., figs. 1-3.
Common.

15. *Cassidulina lævigata*. D'Orbigny, 1826.
 Williamson (R. F.), p. 68, pl. vi., figs. 141, 142.
 Brady (C. R.), 1884, p. 428, pl. liv., figs. 1-3.
 Many of this form are to be found exceedingly large,
 and are splendid specimens. Common.
16. *Cassidulina crassa*. D'Orbigny, 1839.
 Williamson (R. F.), 1858, p. 69, pl. vi., figs. 143, 144.
 Brady (C. R.), 1884, p. 429, pl. liv., figs. 4, 5.
 Very rare.
17. *Bolivina plicata*. D'Orbigny, 1839.
 Brady, Ann. and Mag. Nat. Hist., 1870, p. 302,
 pl. xii., fig. 7. Rare.
18. *Bolivina dilatata*. Reuss, 1849.
 Williamson (R. F.), 1858, p. 76, pl. vi., figs. 164, 165.
 Brady (C. R.), 1884, p. 418, pl. lii., figs. 20, 21.
 Rare.
19. *Lagena lævis*, var. *clavata*. D'Orbigny, 1846.
 Williamson (R. F.), 1858, p. 5, pl. i., fig. 6. Rare.
20. *Lagena striata*. D'Orbigny, 1839.
 Williamson (R. F.), 1858, p. 7, pl. i., fig. 14.
 Brady (C. R.), 1884, p. 460, pl. lvii., figs. 22, 24, 28,
 29, &c. Rare.
21. *Lagena acuticosta*. Reuss, 1861.
 Brady (C. R.), 1884, p. 464, pl. lviii., figs. 20 (?) 21.
 This variety has fewer costæ, and in greater
 elevation than the normal form. Rare.
 F. G. Pearcey, Foraminifera Faroe Channel, Trans.
 Nat. Hist. Soc., Glasgow, 1888, p. 17 (reprint),
 mentions the fact that a few of this variety were
 found in the cold area. Rare.
22. *Lagena gracilis*. Williamson, 1848.
 Williamson, Ann. and Mag. Nat. Hist., 1848, p. 13,
 pl. i., fig. 5.
 Williamson (R. F.), 1858, p. 7, pl. i., figs. 12, 13.
 Brady (C. R.), 1884, p. 464, pl. lviii., figs. 2, 3, 7-10,
 19, 22-4. Rare.
23. *Lagena striato-punctata*. Parker and Jones, 1865.
 Parker and Jones, Phil. Trans., 1865, p. 350, pl. xiii.,
 figs. 25, 27.
 Brady (C. R.), 1884, p. 468, pl. lviii., figs. 37-40.
 H. B. Brady, in (C. R.), p. 783. table iv., high
 latitudes, does not mention it having been found
 off the coast of Norway.
 One of the specimens has two rows of punctæ, one
 each side of the rib, this being unusual.
 Very rare.

24. *Lagena squamosa*. Montagu, 1803.
 Williamson (R. F.), 1858, p. 12, pl. i., fig. 29.
 Brady (C. R.), 1884, p. 471, pl. lviii., figs. 28-31.
 Common.
25. *Lagena marginata*. Walker and Boys, 1784.
 Williamson (R. F.), 1858, p. 10, pl. i., fig. 21.
 Brady (C. R.), 1884, p. 476, pl. lix., figs. 21-3.
 Very common.
26. *Lagena marginata*, var. *trigona*. Parker and Jones.
 J. Wright, Proc. Bel. Nat. Field Club, 1876-7,
 Appendix, p. 104, pl. iv., figs. 8, *a*, *b*.
 I do not see any reason for separating the trigonal
 from the typical form; these trigonal forms are
 always much rarer than the usual form.
 Very rare.
27. *Lagena globosa*. Montagu, 1803.
 Williamson (R. F.), 1858, p. 8, pl. i., figs. 15, 16.
 Brady (C. R.), 1884, p. 452, pl. lvi., figs. 1, 2, 3.
 Rare.
28. *Lagena semistriata*. Williamson, 1848.
 Williamson (R. F.), 1858, p. 6, pl. i., fig. 9.
 Brady (C. R.), 1884, p. 465, pl. lvii., figs. 14, 16, 17
 (18, 20?).
 Frequent.
29. *Lagena lagenoides*. Williamson, 1858.
 Williamson (R. F.), 1858, p. 11, pl. i., figs. 25, 26.
 Brady (C. R.), 1884, p. 479, pl. lx., figs. 6, 7, 9, 12-14.
 Rare.
30. *Lagena Williamsoni*. Alcock, 1865.
 Alcock, Proc. Lit. and Phil. Soc., Manchester, 1865,
 p. 195.
 Balkwill and Wright, Recent Dublin Foraminifera,
 Proc. Royal Irish Acad., 1884, p. 339, pl. xiv.,
 figs. 6-8.
 Brady (C. R.), 1884, pp. 445, 463.
 Common.
31. *Polymorphina gibba*. D'Orbigny, 1826.
 Parker and Jones, Trans. Linn. Soc., London, 1870,
 p. 216, pl. xxxix., figs. 2, *a*, *b*.
 Brady (C. R.), 1884, p. 561, pl. lxxi., figs. 12, *a*, *b*.
 Common.
32. *Polymorphina lactea*. Walker and Jacob, 1798.
 Williamson (R. F.), 1858, p. 70, pl. vi., fig. 147.
 Brady (C. R.), 1884, p. 562.
 H. B. Brady, J. Wright. and others, think that there
 is but little distinction between *P. gibba* and
P. lactea.
 Common.

33. *Polymorphina compressa*. D'Orbigny, 1846.
Williamson (R. F.), 1858, p. 70, pl. vi., figs. 145, 146.
Brady (C. R.), 1884, p. 565, pl. lxxii., figs. 9-11.
Frequent.
34. *Uvigerina angulosa*. Williamson, 1858.
Williamson (R. F.), 1858, p. 66, pl. v., figs. 138, 139.
Brady (C. R.), 1884, p. 576, pl. lxxiv., figs. 15-18.
F. G. Pearcey, For. Faroe Channel, Trans. Nat. Hist. Soc., Glasgow, 1884, p. 18 (reprint), rare in warm area, common in cold area. Frequent.
35. *Lagrina dimorpha*. Parker and Jones, 1865.
Parker and Jones, Phil. Trans., 1865, p. 420, pl. xviii., fig. 18.
Brady (C. R.), 1884, p. 582, pl. lxxvi., figs. 1-3.
Not mentioned by F. G. Pearcey, Faroe Channel. Specimens found off the Scottish coast by D. Robertson; not mentioned in (C.R.) page 784, table iv., as found coast of Norway, but at p. 582. "It extends as far north as Bukken and Oster Fjords, near Bergen, Norway. (Norman)." Very rare.
36. *Globigerina bulloides*. D'Orbigny, 1826.
Williamson (R. F.), 1858, p. 56, pl. v., figs. 116-118.
Brady (C. R.), 1884, p. 593, pl. lxxvii.; pl. lxxix., figs. 3-7. Very rare.
37. *Orbulina universa*. D'Orbigny, 1839.
Williamson (R. F.), 1858, p. 2, pl. i., fig. 4.
Brady (C. R.), 1884, pp. 605-611, pl. lxxviii.; pl. lxxxi., figs. 8-26; pl. lxxxii., figs. 1-3. Very rare.
38. *Spirillina limbata*. H. B. Brady, 1879.
Brady, Quart. Jour. Micr. Sci., 1879, p. 278, pl. viii., figs. 26, *a*, *b*.
Brady (C. R.), 1884, p. 632, pl. lxxxv., figs. 18-21.
Only one found. But for the ornamentation of the surface, might have been mistaken for *Cornuspira crassisepta*. Very rare.
39. *Patellina corrugata*. Williamson, 1858.
Williamson (R. F.), 1858, p. 46, pl. iii., figs. 86-89.
Brady (C. R.), 1884, pp. 633, 634, pl. lxxxvi., figs. 1-7. Frequent.
40. *Discorbina globularis*. D'Orbigny, 1826.
Williamson (R. F.), 1858, p. 53, pl. iv., figs. 1-4.
Brady (C. R.), 1884, p. 643, pl. lxxxvi., figs. 8, 13. Frequent.
41. *Discorbina orbicularis*. Terquem, 1876.
Brady (C. R.), 1884, p. 647, pl. lxxxviii., figs. 4-8. Frequent.

42. *Discorbina tabernacularis*. Brady, 1881.
 Brady, Quart. Jour. Micr. Sci., 1881, p. 65.
 Brady (C. R.), 1884, p. 648, pl. lxxxix., figs. 5-7.
 It is singular to find a form like this in such a locality.
 as it has been spoken of as a minute coral-reef
 species, and for localities, S. Pacific, and the
 nearest as St. Vincent, Cape de Verde Islands.
 This specimen is a large one, and has been sub-
 mitted to the examination of Professor Rup.
 Jones and Mr. C. D. Sherborn. Only one found.
43. *Truncatulina refulgens*. Montfort, 1808.
 Brady (C. R.), 1884, p. 659, pl. xcii., figs. 7-9.
 Frequent.
44. *Truncatulina lobatula*. Walker and Jacob, 1784.
 Williamson (R. F.), 1858, p. 59, pl. v., figs. 121, 123.
 Brady (C. R.), 1884, p. 660, pl. xcii., fig. 10; pl.
 xciii., figs. 1, 4, 5; pl. cxv., figs. 4, 5.
 Very common.
45. *Nonionina umbilicatula*. Montagu, 1803.
 Williamson (R. F.), 1858, p. 32, pl. iii., figs. 68, 69.
 Brady (C. R.), 1884, p. 726, pl. cix., figs. 8, 9.
 Frequent.
46. *Nonionina depressula*. Walker and Jacob, 1798.
 Williamson (R. F.), 1858, p. 97, pl. iii., figs. 70, 71.
 Brady (C. R.), 1884, p. 725, pl. cix., figs. 6, 7.
 Frequent.
47. *Nonionina scapha*. Fichtel and Moll, 1803.
 Brady (C. R.), 1884, p. 730, pl. cix., figs. 14, *a*, *b*,
 15, 16? Very common.
48. *Nonionina stelligera*. D'Orbigny, 1839.
 Brady, H. B., Trans. Linn. Soc., Lond., 1864, p. 471,
 pl. xlviii, fig. 19.
 Brady (C. R.), 1884, p. 728, pl. cix., figs. 3-5.
 Frequent.
49. *Polystomella crispa*. Linne, 1767.
 Williamson (R. F.), 1858, p. 40, pl. iii., figs. 78-80.
 Brady (C. R.), 1884, pp. 731, 732, 736, pl. cx., figs.
 6, 7. Frequent.
50. *Polystomella striato-punctata*. Fichtel and Moll, 1803.
 Williamson (R. F.), 1858, p. 42, pl. iii., figs. 81, 82.
 Very common.
51. *Operculina ammonoides*. Gronovius, 1781.
 Williamson (R. F.), 1858, p. 35, pl. iii., figs. 74, 75.
 Brady (C. R.), 1884, p. 745, pl. cxii., figs. 1, 2.
 Very common.

ON THE GULF STREAM AND ITS EFFECT UPON THE CLIMATE AND PLANTS OF ENGLAND AND NORWAY.*

BY W. P. MARSHALL, M.I.C.E.

The Gulf Stream is the most important of all the ocean currents, both on account of its great extent, and of the remarkable effect that it produces in actually changing the climate of a portion of the world. It is well known by name from books on geography, but is not at all realised until actually seen, as I found when crossing the Stream in the passage to America, and subsequently in witnessing its effects upon the climate and plants of Norway. The Gulf Stream takes its name from the Gulf of Mexico, from which the stream starts; and it travels the whole length of the North Atlantic Ocean, a distance of 5000 miles, to the North Cape, the northern extremity of Norway.

The Gulf Stream has its origin in the great Equatorial Current which follows the sun across the Atlantic, from the Coast of Africa to the Gulf of Mexico, a distance of 7000 miles, and is considered to be produced by the action of the Trade Wind upon the surface of the ocean, the Trade Wind being a wind constantly blowing from east to west in that region, following the sun.

The Equatorial Current is a comparatively shallow surface current, not extending deeper than about 300 feet, and flowing with a moderate speed of about three quarters of a mile an hour; but when it enters the contracted passage between the West Indian Islands and the main land, the velocity of the current increases considerably, and it then sweeps completely round the Gulf of Mexico, from which it issues as the Gulf Stream at a velocity of three to four miles an hour. The temperature of the Equatorial Current is about 82°, and the water is further heated up to 88° in the hot caldron of the Gulf of Mexico. The stream is about 50 miles wide on leaving the Gulf.

The temperature of the Gulf Stream is still as high as 84° when opposite the southern part of the United States, where the stream extends to about 150 miles' width, and opposite New York the temperature is 77°, and the width is extended to nearly 300 miles. The stream crosses the Atlantic, sweeping past the British Isles, where its average temperature is still as high as 50°, and a remarkable effect is produced in

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raising the winter temperature, making a mild winter climate along the western shore of England, Scotland, and Ireland.

A still more remarkable effect, however, is produced on the further coast of Norway, where the Gulf Stream impinges direct upon the coast, and is deflected by it northwards until it passes the North Cape into the Arctic Ocean. The full effect produced in change of temperature is strikingly illustrated by the remarkable displacement effected in the curve of 32° mean temperature; or the line passing through the different places where the average annual temperature is the freezing point, the cold in winter falling on the average as much below the freezing point as the heat in summer rises above it. If there were no disturbing cause, this line would be a circle parallel to the Arctic Circle, at about 50 miles' distance southwards from the Arctic Circle; but instead of this the line is indented by the action of the Gulf Stream, past the North Cape, to a distance as much as 600 miles north of the Arctic Circle, although at the two middle points of the continents of Asia and America the line is carried 1000 miles south of the Arctic Circle.

The enormous warming power of the Gulf Stream will be better realised when it is considered that there is a constant stream of heated water, 300 miles in width and not far from a quarter-mile in thickness, that is being continuously cooled down from an average temperature of about 50° to the freezing point in passing from opposite the British Isles to some distance beyond the North Cape. The effect of the continuous liberation of this enormous amount of heat is such as to completely change the climate of the coast of Norway, as well as greatly affecting the climate of the western coast of the British Isles.

Notwithstanding the high northern latitude of Norway—Bergen, the present capital, being in the same latitude as St. Petersburg; Trondhjem, the ancient capital, in the same latitude as Iceland; and the North Cape so far within the Arctic Circle as to be in the same latitude as the ice-bound North-West passage along the northern coast of America—the whole coast of Norway, even on to the North Cape, enjoys so mild a climate that the harbours are not frozen even in the depth of winter, and a luxuriant vegetation is found with abundant flowering plants even on the top of the North Cape itself.

At Hammerfest, which is the most northern town in the world, and within half a day's sail of the North Cape, the harbour is not frozen even in the long winter, when the sun is altogether lost sight of for a period of two and a half

months. When I was there last summer it was glorious hot summer weather, the thermometer being actually at 70° in the shade at midday ; and on the top of the North Cape at midnight the temperature was as high as 55° ; although Greenland, which is opposite, in the same latitude, is simply one mass of snow-covered glacier.

The spécial cause of this great cold in Greenland is another ocean stream, which is the counterpart of the Gulf Stream, namely, the Arctic Current. As the Gulf Stream is constantly carrying so large a quantity of water into the Arctic Ocean, there must necessarily be some equivalent counterbalancing current flowing constantly in the opposite direction, as the general ocean surface cannot stand out of level ; and this return current is the Arctic Current, which flows southward between Spitzbergen and Greenland, passing along the coast of Greenland, and washing the entire eastern coast of America from Newfoundland to Florida. The Gulf Stream and the Arctic Current are continuous with one another in consequence ; and the Gulf Stream is known to continue a considerable distance further in an easterly direction along the northern shore of Asia.

The Arctic Current is an ice-cold stream at starting, and it has a remarkable cooling effect on the coast of America ; the opposite to the warming effect of the Gulf Stream on the coast of Norway. At New York, which is as far south as the latitude of Naples, the cold in winter is very severe ; and I met with an illustration of this in the public gardens of New York, where, in digging down at the end of April, frozen ground was met with at a depth of six feet below the surface.

The contrast between the warm Gulf Stream and the cold Arctic Current was strikingly experienced in sailing across to New York at the end of April ; we were for two days passing through the Gulf Stream on account of crossing its direction obliquely, and the morning's bath of sea water, fresh circulating from the outside, was quite disagreeably warm for the two days ; but then the next day the water was quite cold and chilly. The line of division between the warm and cold currents, flowing in opposite directions, is very definitely marked and sudden, and is spoken of as the cold wall boundary. The eastern edge of the Gulf Stream is not sharply defined, and there is an offshoot from it which turns down southwards by the Azores Isles, and is considered to return towards the Gulf of Mexico, making an entire circle in its course.

At the point of close contact of the two streams, hot and cold, past the projecting coast of Newfoundland, the meeting

of the moisture-laden air of the warm stream with the cold air of the other stream results in the widespread and intense fogs that are so prevalent off Newfoundland.

The severe cold of the winter climate in America is illustrated by plant life; ivy and hawthorn are not known there out of doors, because the winters are too severe for them to live through; and a special pleasure to Americans in visiting England is to see the ivy-covered buildings, and the hawthorn hedges in blossom and leaf.

The opposite effect on plant life of the warm Gulf Stream is illustrated by the myrtles and fuchsias growing out of doors through the winter on the west coast of England and Scotland; and in Norway by the large number of flowering plants growing luxuriantly in such high northern latitudes and extending even on to the North Cape, which is only 19 degrees, or 1300 miles' distance, from the North Pole itself.

The direction of motion of the Gulf Stream on leaving the Gulf of Mexico is north-east, crossing the Atlantic obliquely, and this is due not entirely to the direction of the American coast, but partly to the circumstance of the difference in velocity of rotation of the different parts of the earth's surface that are passed over by the stream of water. At the equator, the velocity of rotation of the surface is 1,000 miles an hour; the diameter of the earth being 8,000 miles, and the circumference 24,000 miles, which is passed round in twenty-four hours, or at the rate of 1,000 miles an hour from west to east. This velocity of rotation of the surface of the earth diminishes in proceeding northwards, becoming nothing at the Pole, the velocity being about 900 miles an hour where the Gulf Stream starts, and only 300 miles an hour when reaching the North Cape; so that a difference in velocity of as much as 600 miles an hour has to be lost by the water in the passage, which gives the stream a constant tendency to over-run the surface of the earth in an easterly direction, giving the easterly direction to the stream. The Arctic Current is just in the opposite condition; it starts with a rotating velocity of only 300 miles an hour, which has to be increased in the passage to 900 miles an hour, causing a constant tendency to lag behind in a westerly direction, and the current consequently runs close to the American shore throughout its course. The coldness of the water that is thus maintained along the shore has a marked result in the excellent quality of the fish that are caught along the eastern coast of America, the temperature of the water along the coast being several degrees lower than the general temperature of the ocean.

At the point of exit of the warm stream from the Gulf of Mexico the cold stream passes below it; the cold water being heavier than the warm water (about 1-300th part heavier) sinks to the bottom, whilst the warm water remains at the surface; and in the Caribbean Sea, adjoining the Gulf of Mexico, it has been found that, although the surface temperature is as high as 85° , the temperature of the water at the bottom is only 38° , being a difference of nearly 50° between the Arctic Current flowing in from the north and the Equatorial Current flowing from the east.

The Equatorial Current is considered to be caused by the Trade Wind, which is constantly blowing from east to west, and drags the surface water with it by friction; the friction between air and water being very considerable, as is shown by the heavy scud that is seen flying in a gale at sea, which is water lifted up and carried a long distance by the friction of the wind passing over the surface of the sea. The Trade Wind follows the sun in travelling round the earth from east to west, and arises from its continuous heating action upon the surface, and the consequent heating of the air that is in contact with that surface. Whatever part the sun is shining upon becomes greatly heated, and a heated column of air is produced, that rises up in the atmosphere on account of its lightness, being made about 1-25th part lighter by the expansion resulting from this heating.

This ascending column of heated air has to be replaced by an equal amount of air flowing in from all available directions; but this can only flow in from the east, north, and south, and not from the west, because the sun's heating action is continually advancing westward, and instead of a single column of ascending heated air there is really a continuous east and west wall of heated air constantly ascending, following the course of the sun, and merely varying in its ascending power with the variations of temperature at each point during the 24 hours. The consequence is a continuous wind blowing in to the base of this equatorial wall of heated air from the east, north, and south; the north and south winds balance one another, and the absence of any wind from the west causes the result to be the continuous equatorial wind blowing from the east, known as the Trade Wind.

The Gulf of Mexico appears at first rather a small space for the remarkable bend in the Gulf Stream that takes place there; but it is really a very large space, being as much as 1000 miles in length and 700 miles in width, whilst the stream there is only about 50 miles in width.

The question has sometimes been raised whether any risk of interference with the important Gulf Stream would be incurred by the opening of the Panama Canal as a clear water-way between the Atlantic and Pacific oceans; but the possible amount of such interference will be seen to be quite insignificant, when it is considered how minute the area of passage through the canal will be compared with the sectional area of the Gulf Stream, so that not one per cent. of the water in the Gulf Stream could pass through it.

Scientific Gleanings.

A BOTANICAL MISSION TO THE WEST INDIES, by Mr. D. Morris, forms the subject for the "Kew Bulletin" for May and June.

OXFORD UNIVERSITY has recently sanctioned the expenditure of considerable sums of money in order to provide increased accommodation for the medical and science schools. About £11,000 in all was voted.

"ELEMENTARY CHEMISTRY FOR BEGINNERS" is the title of an excellent little book by our late colleague, Mr. W. Jerome Harrison. The publishers are Messrs. Blackie and Son.

HENFREY'S ELEMENTARY COURSE OF BOTANY.—The section of this book on Cryptogamia, by Mr. A. W. Bennett, amplified and revised by the author, is being reprinted by Messrs. Gurney and Jackson.

TECHNICAL EDUCATION is now occupying the attention of nearly every County Council in England, and we hope shortly to give a concise summary of what has been done in the matter in the principal counties.

THE ROYAL SOCIETY.—Among the recently elected fellows of this society we have to offer our congratulations to Mr. William Napier Shaw, a distinguished member of the Birmingham Grammar School, who has gained many honours at Cambridge.

BRITISH FUNGI.—Mr. Worthington G. Smith, the designer of the cover of this magazine, is preparing for the public gallery of the Botanical Department of the British Museum a series of ninety-six tables illustrating the British Fungi. Every species of the Hymenomycetes will be figured in its natural colours.

BOTANICAL DRAWINGS.—The authorities of Kew Gardens have recently secured about 1,650 original drawings, chiefly of plants which were figured and described in the "Botanical Magazine" from 1800 to 1826. Some of the drawings have not been published.

THE REJUVENESCENCE OF CRYSTALS was the subject of an interesting lecture at the Royal Institution, on 30th January last, by Professor John W. Judd, F.R.S. The substance of it appears in "Nature," of May 28th.

MAMMALS LIVING AND EXTINCT.—Professor Flower and Mr. Lydekker have done zoological science a good turn by collecting into a volume a large number of articles which were written primarily for the "Encyclopædia Britannica," and thus placed them within the reach of students.

A BOTANICAL MANUAL has been issued lately by A. Johnstone, F.G.S. (London: Young J. Pentland), which deserves strong commendation, though it might be very greatly improved if the chapter on physiology, good as it is, had been extended on similar lines to a much greater length.

PHYSIOLOGICAL BOTANY.—The second volume of the great American "Text-Book of Botany," designed by the late Prof. Asa Gray, of which Prof. G. L. Goodale, of Harvard University, is the author, has recently been published in this country by Messrs. Macmillan and Co., and has been favourably reviewed in "The Athenæum."

THE UNIVERSITY OF LONDON.—A good deal of correspondence has appeared lately on the future of this important organisation. Professor Ray Lankester, Mr. Thiselton Dyer, Mr. Dickins, Mr. Karl Pearson, Mr. A. Irving, and others have contributed valuable suggestions which deserve, and are pretty sure to have, most thoughtful consideration.

MEDICAL RESEARCH AT EDINBURGH.—This is the title of a review in a recent number of "Nature" of the third volume of "Laboratory Reports of the Royal College of Physicians of Edinburgh." The reviewer says:—"No laboratory in the Kingdom can show for the same space of time a record of so much good work in so many directions, of which a large part would never have been undertaken had this laboratory not been established." The volume in question contains a valuable article by Drs. Woodhead and Wood on Bacteriology.

THE EXAMINATION OF POTABLE WATERS.—In another article in the ably-conducted journal from which we have just quoted, reference is made to the importance which attaches to the studies of our future Medical Public Health Officers, and it expresses, in forcible language, how necessary it is that these men of to-morrow should be impressed with a sense of the responsibility which attaches to the examination of waters for domestic purposes, and that most serious mischief may and often does result from such investigations being intrusted to incompetent persons.

NATURAL HISTORY IN PUBLIC SCHOOLS.—The Rev. T. A. Preston, in the June number of "Physique," shows with great force, and in a very interesting manner, with how much advantage the study of natural history might in some instances be substituted for cricket and football. He maintains that boys out for a field excursion take a great deal more exercise than is ever taken at cricket. "With those who are keen naturalists," he says, "the mere exercise taken in any one day (not in an excursion) is often such that it might almost be said to require moderating. I have no hesitation in saying that, if exercise alone is to be considered, a field naturalist will take far more than any one at games." It is scarcely needful to remind our readers that Mr. Preston was for many years one of the masters of Marlborough College, and president of its Natural History Society.

THE ROYAL GEOGRAPHICAL SOCIETY.—At the anniversary meeting of the Royal Geographical Society, held on June 15th, the award of the society's honours for the year was made. The founder's medal, awarded to Sir James Hector, director of the Geological Survey, New Zealand, was received on his behalf by Sir Dillon Bell, the Agent-General for New Zealand; and the patron's medal, awarded to Dr. Fridtjof Nansen, was received on his behalf by the Swedish Minister. After the award of various other honours, the successful candidates for the society's prizes given to students of training colleges were introduced by Mr. H. J. Mackinder, Reader in Geography at Oxford. Mr. Mackinder spoke of the progress of geographical education.

THAT DIAMONDS PHOSPHORESCCE under certain conditions has been known ever since Boyle published in the Transactions of the Royal Society in 1663 his well-known paper "On a Remarkable Diamond that Shines in the Dark." Mr. G. F. Kunz, a well-known expert in gems, has recently pointed out, in a New York contemporary, that "some diamonds not only phosphoresce in the dark after exposure to the sunlight or an arc of electric light, but also that all diamonds emit light by rubbing them on wood, cloth or metal, a property which will probably prove of great value in distinguishing between the diamond and other hard stones, as well as paste, none of which exhibit this phenomenon." This property, a scientific contemporary remarks, is evidently not electric, or it would not be visible on the diamond being rubbed on metal.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—MICROSCOPICAL SECTION. June 2nd. Mr. W. B. Grove in the chair. Mr. C. J. Watson exhibited under the microscope a specimen of *Utricularia*, showing the bladders containing numerous algæ; some abnormal crystals of alum, with a series of drawings of the regular and abnormal forms; also a large series of photographs of Uriconium and other interesting localities. Mr. J. Goode then read his paper on the "Mouth-parts of Insects," which he fully illustrated by diagrams and specimens under the microscope. A short discussion, followed by a vote of thanks, terminated the meeting.—GEOLOGICAL SECTION. June 16th. Mr. C. Pumphrey in the chair. Mr. W. H. Wilkinson exhibited plants from Little Orme's Head, including *Scilla verna* and *Helianthemum guttatum*, the rare rock rose, with the dark spot at the base of the petals. Mr. C. Pumphrey exhibited a collection of plants from his garden, including a series of *Aguilegia*, showing various modes of becoming double. Mr. P. W. Marshall gave an account of the collecting ground for the proposed new water supply of Birmingham, and exhibited maps, illustrating his remarks. Supply, 820ft. above sea at commencement of conduit; 532ft. reservoir at Monument Lane; 288ft. total fall in eighty miles; or 3½ft. per mile average.—June 20.—Excursion to Apley Terrace and Badger Dingle. The party numbered about thirty-two, and amongst those present were Mr. C. Pumphrey (the president), who acted as cicerone, Mrs. Pumphrey, Mr. W. P. Marshall and Mr. W. H. Wilkinson (the secretaries), Mrs. Wilkinson, Mr. and Mrs. J. Levick, Mr. and Mrs.

A. Antrobus, Mr. Holden (Walsall), Messrs. W. B. Grove, Greenway, Malins, Lavender, Loxton, &c. The party travelled by the 10 39 train from Snow Hill to Shifnal, where they examined the antique timbered houses, and the architecture and furnishings of the church. After partaking of luncheon at the Jerningham Arms, they started at 12 45 in brakes, and drove past Cosford pumping-engines which supply Wolverhampton with water; then through the pretty village of Beckbury to Badger Dingle. Here the party alighted, and spent an hour in wandering through the winding paths of this charming glen. The view from the "Temple" over the artificial lake was much admired, and awakened desires for a longer stay. There were some well-grown timber trees, and some interesting ornamental ones growing in the dingle, and amongst the pines and firs the glaucous green of a fine *Picea nobilis* shone out with marked effect. The flowers and ferns, although professedly wild, were greatly enriched by the introduction of foreign ones; amongst the former the *Osmunda regalis*, and amongst the latter the *Onoclea sensibilis* were growing in their native luxuriance. The party then drove on to Apley Terrace, and on passing through the entrance-gate into the woods beyond were greeted by the sweet, plaintive tones of the blackbird's note, soon after by those of the reed-warbler, and then by the blackcap, amongst a host of others, while the grassy banks were strewn with many scarce wild flowers, which interested the botanical members of the party. Passing by the cottage in the rock, the party climbed to the top of the terrace and walked along the ridge for some two miles over the grass-covered drive beneath the over-arching branches of the fine avenue of trees. Here the fine views of Apley Castle and the windings of the River Severn were much admired. The party found the carriages waiting, and drove back to Shifnal, where tea was partaken of; and an hour's drive to Albrighton brought a most instructive and interesting day's ramble to an end. The 8 5 train brought them back to Snow Hill, where the party broke up, after congratulating the president on the success of the day.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—May 25th. The President, Prof. Hillhouse, M.A., F.L.S., gave a lecture on "Highly Specialised Flowers." The lecturer said his audience were doubtless well acquainted with ordinary flowers, and like all others had abandoned the idea that they were made for our pleasure. The course of nature was one of arrant selfishness: flowers existed for their own purpose, that of seed-producing organs. The process of fertilisation in an ordinary flower was described, but there were cases where the same end was obtained by special modifications of organs that were only primarily protective organs. The cones of the pine were very simple, yet they were specialised by the production of resin, to which the pollen adhered. The whole object of specialisation was to secure more efficient protection, to produce more seed, or to secure cross-fertilisation. The situation of the ovary in the stalk was a very advanced form. The next type of specialisation was that for facilitating fertilisation; we found this done by odour, colour, and mechanical appliances. When the wind could not distribute pollen it had to be done by insect agency, and in this service they showed themselves as selfish as the flowers. The scent of flowers was not a new departure, for many leaves had the same property. The development of a special colour in a flower is no more than we find in leaves. The many remarkable forms of flowers show us the most advanced forms

of specialisation; many instances are found among orchids, and are for the purpose of making the production of the seed easier and safer. The common pansy was described at length as a flower deserving of special study. The flower was a flag, and in the centre was a bait; insects visiting it for the nectar carried away with them some of the pollen, which found its way to the stigmatic surface of the next flower they visited. After referring to those flowers that were found in clusters, as the daisy, guelder rose, &c., some of which gave themselves up for the welfare of others, the lecturer said he had only picked out a few flowers for the purpose of stimulating observation, and so enabling students to get information for themselves. At the close of the lecture (which was profusely illustrated with diagrams), a hearty vote of thanks was accorded the lecturer.—June 1st. Mr. J. Moore showed specimens of water scorpion, covered with red objects, which were probably eggs; Mr. Deakin, a peculiarly shaped shell of *Limnæa peregra*, probably caused by an injury to the mantle.—June 8th. Mr. J. W. Neville exhibited a pansy with six petals, an abnormal growth that has been continued on all off-sets for several years; Mr. J. Collins, a collection of plants from the Lickey district; Mr. H. Hawkes, specimens of *Laminaria phyllitis*, an uncommon seaweed. Under the microscopes, Mr. Hawkes showed the *Æcidiospore* stage of *Uromyces poæ*; Mr. J. W. Neville, annular vessels in maize; Mr. J. Collins, living diatoms.—June 15th. Mr. J. Collins gave an account of the excursion to Arley, and described the more interesting plants found during the ramble. They comprised specimens of *Aquilegia vulgaris*, and four specimens of *Orchis*; Mr. J. Moore, a collection of water beetles. Under the microscopes, Mr. Parker showed *Carchesium polypinum*; Mr. J. W. Neville, *Melicerta ringens*.

BIRMINGHAM ENTOMOLOGICAL SOCIETY.—June 1st. Mr. R. C. Bradley in the chair. Mr. G. W. Wynn showed eggs of *Endromis versicolor*, found on birch twigs at Wyre Forest. Two small batches have been found placed round the stem, near to the ends of the twigs. He also showed *Teniocampa populeti*, from Marston Green, etc. Mr. A. Johnson showed larvæ of *Hibernia aurantiaria*, bred from specimens taken at Sutton. Mr. R. C. Bradley showed a box of *Pyralidæ* taken from his collection.

OXFORD NATURAL HISTORY SOCIETY.—May 30th. About twenty members took part in a very pleasant excursion to Faringdon and Lechlade. The geology of the district was explained by the President, Professor A. H. Green; but, owing to the backwardness of the season, very little in botany could be done. The most noteworthy feature for the botanical members was a large field dotted with cowslips and *Orchis mascula*.—June 4th. Mr. F. Gotch, M.A., gave a lecture on "Visual Perception." The anatomy of the eye was briefly explained, and the structure of the retina illustrated by means of lantern slides. After describing several of the older theories of vision, Mr. Gotch came to the chief point of his lecture—namely, that *perception of space* is in great part due to the visual impressions formed on the retina, and not an idea which the mind gained by the comparison and recollection of many visual perceptions; or, in other words, perception of space and distance is a thing of the retina, not of the mind. This thesis was maintained by many striking illustrations shown on the screen, and it excited great interest in the society.—June 18th. A paper was read by Mr. F. A. Bellamy, on "Weather Charts and Forecasts, and How they are Made;" of which a full report will appear in a future number.

ANIMAL PEDIGREES.

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(Concluded from page 152.)

An excellent illustration of this downhill progress is afforded by the Rhizocephala, a curious group of parasitic crustaceans, of which the genus *Sacculina* is perhaps the best known member.

The adult *Sacculina*, Fig. 14, is found as a soft, shapeless bag, an inch or so in length, attached to the under surface of the tail of a crab by a fleshy stalk, which, passing through the skin of the crab, spreads out within it into a complicated system of branching tubular roots by which the parasite sucks up the juices of the crab, on which it depends for food.

As regards structure, the *Sacculina* in its fully developed form is little more than a bag of eggs enclosed in a loosely fitting outer skin, with a single orifice through which the young escape. A nervous system is present, but there are no traces of limbs, digestive system, heart, breathing organs, or sense organs. Indeed, examination, however careful, of an adult *Sacculina* would fail to afford any clue as to its real zoological affinities.

Development, however, in obedience to the potent law of recapitulation, shows us at once that *Sacculina* is a Crustacean, more closely allied to the Barnacles than to any other of the more familiar members of the group. From each of the exceedingly numerous eggs which a *Sacculina* produces, there emerges a minute, free swimming larva of the type known as a Nauplius, Fig. 11, characterised by possessing a somewhat pyriform body, a single median eye, and three pairs of swimming appendages or legs. Nauplius larvæ are widely spread amongst Crustaceans. All Entomostraca, except the Cladocerans, hatch in this form, and Nauplius larvæ are found in individual members in nearly all the higher groups as well. The only special peculiarity about the *Sacculina* Nauplius is that it has neither mouth nor digestive organs of any kind, these being rendered unnecessary by the presence of a considerable quantity of food yolk. The *Sacculina* larva continues its free existence for a time; it casts its skin, or rather its cuticle, many times, emerging each time of rather more complicated structure, though of actually smaller size, for it cannot yet take in food. Ultimately it reaches the condition shown in Fig. 12, and spoken of as the pupa stage.

The pupa is enclosed in a bivalved carapace, very similar to that of a Cypris. It possesses a pair of well-developed

antennules in front and six pairs of swimming legs behind. The Nauplius eye is still present, a little way behind the basal joints of the antennules.

Now comes the great change. The pupa, meeting with a crab, fastens itself to the under surface of the crab's tail by its antennules and then goes to the bad with startling rapidity. Within three hours of the time of fixing itself to the crab, the six pairs of swimming legs, with the muscles moving them, and the whole posterior part of the body rot away, and are cast off as a slough. The antennules become modified into a tube, piercing the skin of the crab; the head of the Sacculina remains as a bottle-shaped mass in connection with the modified antennules, but the bivalved carapace, with all the other organs, including the eye, are cast off and lost, Fig. 13. The Sacculina now passes for a time completely into the interior of the crab: later on, after increasing in size, it comes once more to the surface and becomes the bag-like mass which we have found to be the adult condition, Fig. 14.

This is a typical instance of degeneration or retrograde development, the animal being more highly organised, and standing at a higher morphological level in its early stages than when adult. Yet, inasmuch as the organs that are lost, such as the limbs and eye, would be of no use to it in its changed conditions of life, there is nothing in the whole history that is in any way inconsistent with natural selection.

This principle of degeneration, recognised by Darwin as a possible, and, under certain conditions, a necessary consequence of his theory, has been since advocated strongly by Dohrn, and later by Lankester, in an evening discourse delivered before the British Association at the Sheffield meeting, in 1879. Both Dohrn and Lankester have suggested that degeneration may occur much more widely than is commonly supposed.

In animals which are parasitic when adult, but free swimming in their early stages, as in the case of Sacculina, degeneration is clear enough; so also is it in the case of the solitary Ascidians, in which the larva is a free swimming animal with a notochord, an elongated tubular nervous system, and sense organs, while the adult is fixed, devoid of the swimming tail, with no notochord, and with a greatly reduced nervous system and aborted sense organs.

In such cases the animal, when adult, is, as regards the totality of its organisation, at a distinctly lower morphological level, is less highly differentiated than it is when young, and during individual development there is actual retrograde development of important systems and organs.

About such cases there is no doubt; but we are asked to extend the idea of degeneration much more widely. It is urged that we ought not to demand direct embryological evidence before accepting a group as degenerate. We are reminded of the tendency to abbreviation or to complete omission of ancestral stages of which we have quoted examples above; and it is suggested that if such larval stages were omitted in all the members of a group we should have no direct evidence of degeneration in a group that might really be in an extremely degenerate condition.

Supposing, for instance, the free larval stages of the solitary Ascidians were suppressed, say through the acquisition of food yolk, then it is urged that the degenerate condition of the group might easily escape detection. The supposition is by no means extravagant; food yolk varies greatly in amount in allied animals, and cases like *Hylodes*, or, amongst Ascidians, *Pyrosoma*, show how readily a mere increase in the amount of food yolk in the egg may lead to the omission of important ancestral stages.

The question then arises whether it is not possible, or even probable, that animals which now show no indication of degeneration in their development are in reality highly degenerate, and whether it is not legitimate to suppose such degeneration to have occurred in the case of animals whose affinities are obscure or difficult to determine.

It is more especially with regard to the lower vertebrates that this argument has been employed; and at the present day zoologists of authority, relying on it, do not hesitate to speak of such forms as *Amphioxus* and the Cyclostomes as degenerate animals, as wolves in sheep's clothing, animals whose simplicity is acquired and deceptive rather than real and ancestral.

I cannot but think that cases such as these should be regarded with some jealousy; there is at present a tendency to invoke degeneration rather freely as a talisman to extricate us from morphological difficulties; and an inclination to accept such suggestions, at any rate provisionally, without requiring satisfactory evidence in their support.

Degeneration of which there is direct embryological evidence stands on a very different footing from suspected degeneration, for which no direct evidence is forthcoming; and in the latter case the burden of proof undoubtedly rests with those who assume its existence.

The alleged instances among the lower vertebrates must be regarded particularly closely, because in their case the suggestion of degeneration is admittedly put forward as a

means of escape from difficulties arising through theoretical views concerning the relation between vertebrates and invertebrates.

Amphioxus itself, so far as I can see, shows in its development no sign of degeneration, except possibly with regard to the anterior gut diverticula, whose ultimate fate is not altogether clear. With regard to the earlier stages of development, concerning which, thanks to the patient investigations of Kowalevsky and Hatschek, our knowledge is precise, there is no animal known to us in which the sequence of events is simpler or more straightforward. Its various organs and systems are formed in what is recognised as a primitive manner; and the development of each is a steady upward progress towards the adult condition. Food yolk, the great cause of distortion in development, is almost absent, and there is not the slightest indication of the former possession of a larger quantity. Concerning the later stages our knowledge is incomplete, but so much as has been ascertained gives no support to the suggestion of general degeneration.

Our knowledge of the conditions leading to degeneration is undoubtedly incomplete, but it must be noticed that the conditions usually associated with degeneration do not occur. *Amphioxus* is not parasitic, is not attached when adult, and shows no evidence of having formerly possessed food yolk in quantity sufficient to have led to the omission of important ancestral stages. Its small size as compared with other vertebrates, is one of the very few points that can be referred to as possibly indicating degeneration, but by no means proving its occurrence.

A consideration of much less importance, but deserving of mention, is that in its mode of life *Amphioxus* not merely differs, as already noticed, from those groups of animals which we know to be degenerate, but agrees with some, at any rate, of those which there is reason to regard as primitive or persistent types. *Amphioxus*, like *Balanoglossus*, *Lingula*, *Dentalium*, and *Limulus*, is marine, and occurs in shallow water, usually with a sandy bottom, and, like the three smaller of these genera, it lives habitually buried almost completely in the sand, into which it burrows with great rapidity.

I do not wish to speak dogmatically. I merely wish to protest against a too ready assumption of degeneration; and to repeat that, so far as I can see, *Amphioxus* has not yet, either in its development, in its structure, or in its habits, been shown to present characters that suggest, still less that prove, the occurrence in it of general or extensive degeneration.

In a sense, all the higher animals are degenerate ; that is, they can be shown to possess certain organs in a less highly developed condition than their ancestors, or even in a rudimentary state.

Thus a crab as compared with a lobster is degenerate in the matter of its tail, a horse as compared with *Hipparion* in regard to its outer toes ; but it is neither customary nor advisable to speak of a crab as a degenerate animal compared to a lobster ; to do so would be misleading. An animal should only be spoken of as degenerate when the retrograde development is well marked, and has affected not one or two organs only, but the totality of its organisation.

It is impossible to draw a sharp line in such cases, and to limit precisely the use of the term degeneration. It must be borne in mind that no animal is at the top of the tree in all respects. Man himself is primitive as regards the number of his toes, and degenerate in respect to his ear muscles ; and between two animals even of the same group it may be impossible to decide which of the two is to be called the higher and which the lower form.

Thus, to compare an oyster with a mussel. The oyster is more primitive than the mussel as regards the position of the ventricle of the heart and its relations to the alimentary canal ; but is more modified in having but a single adductor muscle ; and almost certainly degenerate in being devoid of a foot.

Care must also be taken to avoid speaking of an animal as degenerate in regard to a particular organ merely because that organ is less fully developed than in allied animals. An organ is not degenerate unless its present possessor has it in a less perfect condition than its ancestors had.

A man is not degenerate in the matter of the length of his neck as compared with a giraffe, nor as compared with an elephant in respect of the size of his front teeth, for neither elephant nor giraffe enters into the pedigree of man. A man is, however, degenerate, whoever his ancestors may have been, in regard to his ear muscles ; for he possesses these in a rudimentary and functionless condition, which can only be explained by descent from some better equipped progenitor.

We have now considered some of the more important of the influences which are recognised as affecting developmental history in such a way as to render the recapitulation of ancestral stages less complete than it might otherwise be ; which tend to prevent ontogeny from correctly repeating the phylogenetic history. It may at this point reasonably be asked whether there is any test by which we can determine whether a given larval character is or is not ancestral.

Most assuredly there is no one rule, no single test, that will apply in all cases; but there are certain considerations which will help us, and which should be kept in view.

A character that is of general occurrence among the members of a group, both high and low, may reasonably be regarded as having strong claims to ancestral rank; claims that are greatly strengthened if it occurs at corresponding developmental periods in all cases; and still more if it occurs equally in forms that hatch early as free larvæ, and in forms with large eggs, which develop directly into the adult. As examples of such characters may be cited the mode of formation and relations of the notochord, and of the gill-clefts of vertebrates, which satisfy all the conditions mentioned.

Characters that are transitory in certain groups, but retained throughout life in allied groups, may, with tolerable certainty, be regarded as ancestral for the former; for instance, the symmetrical position of the eyes in young flatfish, the spiral shell of the young limpet, the superficial position of the madreporite in Elasipodous Holothurians, or the suckerless condition of the ambulacral feet in many Echinoderms.

A more important consideration is that if the developmental changes are to be interpreted as a correct record of ancestral history, then the several stages must be possible ones, the history must be one that could actually have occurred, *i.e.*, the several steps of the history as reconstructed must form a series, all the stages of which are practicable ones.

Natural selection explains the actual structure of a complex organ as having been acquired by the preservation of a series of stages, each a distinct, if slight, advance on the stage immediately preceding it, an advance so distinct as to confer on its possessor an appreciable advantage in the struggle for existence. It is not enough that the ultimate stage should be more advantageous than the initial or earlier condition, but each intermediate stage must also be a distinct advance. If, then, the development of an organ is strictly recapitulatory, it should present to us a series of stages, each of which is not merely functional, but a distinct advance on the stage immediately preceding it. Intermediate stages, *e.g.*, the solid œsophagus of the tadpole, which are not and could not be functional, can form no part of an ancestral series; a consideration well expressed by Sedgwick thus:—"Any phylogenetic hypothesis which presents difficulties from a physiological standpoint must be regarded as very provisional indeed."

A good example of an embryological series fulfilling these conditions is afforded by the development of the eye in the higher Cephalopoda. The earliest stage consists in the depression of a slightly modified patch of skin; round the edge of the patch the epidermis becomes raised up as a rim; this gradually grows inwards from all sides, so that the depressed patch now forms a pit, communicating with the exterior through a small hole or mouth. By further growth the mouth of the pit becomes still more narrowed, and ultimately completely closed, so that the pit becomes converted into a closed sac or vesicle; at the point at which final closure occurs formation of cuticle takes place, which projects as a small transparent drop into the cavity of the sac; by formation of concentric layers of cuticle this drop becomes enlarged into the spherical transparent lens of the eye; and the development is completed by histological changes in the inner wall of the vesicle, which convert it into the retina, and by the formation of folds of skin around the eye, which become the iris and the eyelids respectively.

Each stage of this developmental history is a distinct advance, physiologically, on the preceding stage, and, furthermore, each stage is retained at the present day as the permanent condition of the eye in some member of the group Mollusca.

The earliest stage, in which the eye is merely a slightly depressed and slightly modified patch of skin, represents the simplest condition of the Molluscan eye, and is retained throughout life in Solen. The stage in which the eye is a pit, with widely open mouth, is retained in the limpet; it is a distinct advance on the former, as through the greater depression the sensory cells are less exposed to accidental injury.

The narrowing of the mouth of the pit in the next stage is a simple change, but a very important step forward. Up to this point the eye has served to distinguish light from darkness, but the formation of an image has been impossible. Now, owing to the smallness of the aperture, and the pigmentation of the walls of the pit which accompanies the change, light from any one part of an object can only fall on one particular part of the inner wall of the pit or retina, and so an image, though a dim one, is formed. This type of eye is permanently retained in the Nautilus.

The closing of the mouth of the pit by a transparent membrane will not affect the optical properties of the eye, and will be a gain, as it will prevent the entrance of foreign bodies into the cavity of the eye.

The formation of the lens by deposit of cuticle is the next

step. The gain here is increased distinctness and increased brightness of the image, for the lens will focus the rays of light more sharply on the retina, and will allow a greater quantity of light, a larger pencil of rays from each part of the object, to reach the corresponding part of the retina. The eye is now in the condition in which it remains throughout life in the snail and other gastropods. Finally the formation of the folds of skin known as iris and eyelids provides for the better protection of the eye, and is a clear advance on the somewhat clumsy method of withdrawal seen in the snail.

It is not always possible to point out so clearly as in the above instance the particular advantage gained at each step, even when a complete developmental series is known to us; but in such cases, as for instance in Orbitolites, our difficulties may be largely ascribed to ignorance of the particular conditions that confer advantage in the struggle for existence in the case of the forms we are dealing with.

That ontogeny really is a repetition of phylogeny must, I think, be admitted, in spite of the numerous and various ways in which the ancestral history may be distorted during actual development.

Before leaving the subject, it is worth while inquiring whether any explanation can be found of recapitulation. A complete answer can certainly not be given at present, but a partial one may, perhaps, be obtained.

Darwin himself suggested that the clue might be found in the consideration that at whatever age a variation first appears in the parent, it tends to reappear at a corresponding age in the offspring; but this must be regarded rather as a statement of the fundamental fact of embryology than as an explanation of it.

It is probably safe to assume that animals would not recapitulate unless they were compelled to do so: that there must be some constraining influence at work, forcing them to repeat more or less closely the ancestral stages. It is impossible, for instance, to conceive what advantage it can be to a reptilian or mammalian embryo to develop gill-clefts which are never used, and which disappear at a slightly later stage; or how it can benefit a whale, that in its embryonic condition it should possess teeth which never cut the gum, and which are lost before birth.

Moreover, the history of development in different animals or groups of animals offers to us, as we have seen, a series of ingenious, determined, varied, but more or less unsuccessful efforts to escape from the necessity of recapitulating, and to substitute for the ancestral process a more direct method.

A further consideration of importance is that recapitulation is not seen in all forms of development, but only in sexual development; or, at least, only in development from the egg. In the several forms of asexual development, of which budding is the most frequent and most familiar, there is no repetition of ancestral phases; neither is there in cases of regeneration of lost parts, such as the tentacle of a snail, the arm of a starfish, or the tail of a lizard; in such regeneration it is not a larval tentacle, or arm, or tail, that is produced, but an adult one.

The most striking point about the development of the higher animals is that they all alike commence as eggs. Looking more closely at the egg and the conditions of its development, two facts impress us as of special importance; first, the egg is a single cell, and therefore represents morphologically the Protozoan, or earliest ancestral phase; secondly, the egg, before it can develop, must be fertilised by a spermatozoon, just as the stimulus of fertilisation by the pollen grain is necessary before the ovum of a plant will commence to develop into the plant-embryo.

The advantage of cross-fertilisation in increasing the vigour of the offspring is well known, and in plants devices of the most varied and even extraordinary kind are adopted to ensure that such cross-fertilisation occurs. The essence of the act of cross-fertilisation, which is already established among Protozoa, consists in combination of the nuclei of two cells, male and female, derived from different individuals. The nature of the process is of such a kind that two individual cells are alone concerned in it; and it may, I think, be reasonably argued that the reason why animals commence their existence as eggs, *i.e.*, as single cells, is because it is in this way only that the advantage of cross-fertilisation can be secured, an advantage admittedly of the greatest importance, and to secure which natural selection would operate powerfully,

The occurrence of parthenogenesis, either occasionally or normally, in certain groups is not, I think, a serious objection to this view. There are very strong reasons for holding that parthenogenetic development is a modified form, derived from the sexual method. Moreover, the view advanced above does not require that cross-fertilisation should be essential to individual development, but merely that it should be in the highest degree advantageous to the species, and hence leaves room for the occurrence, exceptionally, of parthenogenetic development.

If it be objected that this is laying too much stress on sexual reproduction, and on the advantage of cross-fertilisa-

tion, then it may be pointed out in reply that sexual reproduction is the characteristic and essential mode of multiplication among Metazoa: that it occurs in all Metazoa, and that when asexual reproduction, as by budding, etc., occurs, this merely alternates with the sexual process which, sooner or later, becomes essential.

If the fundamental importance of sexual reproduction to the welfare of the species be granted, and if it be further admitted that Metazoa are descended from Protozoa, then we see that there is really a constraining force of a most powerful nature compelling every animal to commence its life history in the unicellular condition, the only condition in which the advantage of cross-fertilisation can be obtained; *i.e.*, constraining every animal to begin its development at its earliest ancestral stage, at the very bottom of its genealogical tree.

On this view the actual development of any animal is strictly limited at both ends: it must commence as an egg, and it must end in the likeness of the parent. The problem of recapitulation becomes thereby greatly narrowed; all that remains being to explain why the intermediate stages in the actual development should repeat the intermediate stages of the ancestral history.

Although narrowed in this way, the problem still remains one of extreme difficulty.

It is a consequence of the Theory of Natural Selection that identity of structure involves community of descent: a given result can only be arrived at through a given sequence of events: the same morphological goal cannot be reached by two independent paths. A negro and a white man have had common ancestors in the past; and it is through the long-continued action of selection and environment that the two types have been gradually evolved. You cannot turn a white man into a negro merely by sending him to live in Africa: to create a negro the whole ancestral history would have to be repeated; and it may be that it is for the same reason that the embryo must repeat or recapitulate its ancestral history in order to reach the adult goal.

I am not sure that we can get much further than this at present.

However, be the explanation what it may, there can, I think, be no doubt as to the general truth of the Recapitulation Theory, and the wonderful assistance which it gives us in reconstructing the pedigrees of animals. Yet it must not be supposed that all we have to do in order to determine the past history of a species is to study the actual development of the existing members of that species.

Embryology is not to be regarded as a master-key that will open the gates of knowledge, and remove all obstacles from our path without further trouble on our part; it is rather to be viewed and treated as a delicate and complicated instrument, the proper handling of which requires the utmost nicety of balance and adjustment, and which unless employed with the greatest skill and judgment may yield false instead of true results.

We are, indeed, only just beginning to understand the real power of our weapons and the right way of employing them; and in the future embryology, especially when studied, as it should be, in conjunction with palæontology, may be confidently relied on to afford a far clearer insight than we have yet obtained into the history of life on the earth.

DESCRIPTION OF THE FIGURES.

Figs. 1 to 4.—Shells of *Peneroplis* and of *Orbitolites*, members of the group of Porcellanous Foraminifera, illustrating the mode of transition from the spiral to the discoidal shell. (After Brady and Carpenter.)

Fig. 1.—An adult *Peneroplis* shell. The shell is spiral and chambered, the later formed chambers being very wide, and having a tendency to overlap the preceding ones. $\times 20$.

Fig. 2.—A young *Orbitolites* shell, in the *Peneroplis* stage of development. The shell is spiral and chambered, the last formed chambers having a more marked tendency to overlap the preceding ones than in *Peneroplis*. The last or marginal chamber in the specimen figured extends almost the whole way round. $\times 30$.

Fig. 3.—An adult *Orbitolites* shell, seen edgewise so as to show the thickness of the disc, and the marginal pores through which the pseudopodia are protruded during life. $\times 7$.

Fig. 4.—An adult *Orbitolites* shell, seen full face. In the centre is the spiral nucleus, which is the oldest part of the shell, and was originally the only part present; then comes a part in which the successive chambers become wider and wider, and overlap the older part of the shell more and more completely (compare Fig. 2), and finally the marginal and latest formed part in which each chamber is circular and completely surrounds its predecessors.

The fainter radial lines indicate the secondary partitions by which the chambers are subdivided. $\times 7$.

Figs. 5 to 7.—Young and adult specimens of the Flounder (*Pleuronectes flesus*), to illustrate the shifting of the eye from one side of the head to the other during the growth of the fish.

Fig. 5.—A young Flounder six days after hatching. The head is symmetrical, and the eyes one on each side. (After Cunningham.) $\times 4$.

Fig. 6.—A young Flounder, probably about a month old. The fish is gradually acquiring the characteristic shape of the adult, and the head is becoming twisted, the eye of the right side being displaced slightly downwards, and the eye of the left side coming into view over the top of the skull. (After Cunningham.) $\times 4$.

Fig. 7.—An adult Flounder showing the characteristic shape of the flat-fish, and the complete migration of the left eye over to the right side of the head. (After Buckland and Couch.) $\times \frac{1}{2}$.

Figs. 8 to 10.—Young and adult specimens of one of the swimming Crabs (*Portunus*), to illustrate the transition from the long-tailed to the short-tailed condition,

Fig. 8.—The Zoea stage, characterised by the great length of the spines on the cephalothorax; by the large size of the powerful rowing maxillipedes; and by the long, jointed tail. The larva is swimming in the direction of the long dorsal spine, the spines serving to guide its course. (After Weldon.) $\times 15$.

Fig. 9.—The Megalopa stage. This is the typical Macrurous condition, comparable to that of an adult Lobster or Prawn. (After Claus.) $\times 5$.

Fig. 10.—The adult Crab. As compared with the Megalopa stage the cephalothorax has increased greatly in width, while the tail has become relatively smaller, and is carried turned forwards beneath the thorax. (After Bell.) $\times \frac{1}{2}$.

Figs. 11 to 14.—Young and adult specimens of *Sacculina*, to illustrate the Degeneration or Retrograde Metamorphosis which the parasite undergoes in the course of its development.

Fig. 11.—The Nauplius stage, in which the young *Sacculina* hatches. The three pairs of appendages correspond to the antennules, antennæ, and mandibles of a Crab or Crayfish. The black spot between the antennules is the eye, and the small patch immediately behind the eye and between the two hinder pairs of appendages is the ovary, which is already present at this very early stage. Unlike the Nauplius stage of other groups of Crustacea the *Sacculina* Nauplius has no mouth or alimentary canal. (After Delage.) $\times 90$.

Fig. 12.—The Cypris or pupa stage. It is at this stage that the young *Sacculina*, hitherto a free swimming animal, attaches itself to a Crab and becomes parasitic. The pupa is characterised by the bivalved carapace; the stout antennules by which it fixes itself to the Crab; and the six pairs of locomotor appendages. The black spot is the Nauplius eye, and the mass immediately below it is the ovary. (After Delage.) $\times 90$.

Fig. 13.—The *Sacculina* three days after fixing itself to the Crab. The six pairs of swimming legs have rotted away and fallen off; the bivalved carapace is being detached, and is carrying with it the eye and certain debris from the body. The sole parts remaining, out of which the adult *Sacculina* will be formed, are the antennules, now modified into a tube, which is represented projecting through a piece of the skin of the Crab; and the head, which forms a bottle-shaped mass attached to the tube, and containing the ovary. (After Delage.) $\times 90$.

Fig. 14.—Adult *Sacculina* attached to the ventral surface of the tail of a Crab (*Portunus*). The *Sacculina* is the large dark-coloured bag in the lower part of the figure; it is attached to the Crab by a short fleshy stalk, not seen in the figure, which, penetrating the skin, spreads out into a tuft of branching roots in the Crab's body. (From nature.) $\times \frac{1}{2}$.

Figs. 15 to 18.—Stages in the development of the common Frog, *Rana temporaria*. (From nature.)

Fig. 15.—The egg. $\times 3$.

Fig. 16.—The Tadpole at the time of hatching. The mouth is not yet formed, the Tadpole being still dependent on the food yolk present in its body. Two pairs of external gills are present as branched finger-like processes at the sides of the neck. Below and in front of these is the horse-shoe shaped sucker by which the Tadpole fixes itself, and at the sides of the front of the head the rudiments of the nose and eye are seen. $\times 3$.

Fig. 17.—A Tadpole shortly after the time of appearance of the limbs: the hind limbs are seen at the junction of the body and tail: the fore limbs are present but are concealed by the opercular folds covering the gills. At this stage the Tadpole breathes by both gills and lungs. × 1.

Fig. 18.—A young Frog with the tail only partially absorbed. × 1.

Figs 19 to 22.—Stages in the development of the West Indian Frog, *Hylodes*: illustrating the effect of increased amount of food yolk in causing the omission of ancestral stages. The free living tadpole stage of the common Frog is entirely suppressed, and no gills are ever formed. The entire development from the laying of the eggs to the hatching of the Frogs occupies from a fortnight to three weeks. (After Brehm.)

Fig. 19.—The larva at the end of the first week. The head, eyes, stumps of the limbs, and the long tail are well shown. The food yolk is contained within the large yolk-sac in the middle of the figure. The figure should be compared with Figs. 15 and 16, which are drawn to the same scale. × 3.

Fig. 20.—The young *Hylodes* shortly before hatching. There is still a very large tail present which is believed to be used as a respiratory organ. × 3.

Fig. 21.—Young *Hylodes* at the moment of emerging from the egg: a short stump of a tail is still present. × 3.

Fig. 22.—Young *Hylodes* at the end of the first day. The tail is completely absorbed, and the Frog has already the form of the adult. × 3.

O N C R I N O I D S .*

BY W. MADELEY,

HON. SEC. OF THE DUDLEY AND MIDLAND GEOLOGICAL SOCIETY.

It is not at all surprising that those early naturalists, who directed their attention to the examination of the fossil crinoids, should have considered them to be the petrified remains of some marvellous creations of the vegetable kingdom; and it is uncertain by whom or when the name of *Encrinus* (from the Greek word *κρινον*, a lily) was first applied, but we find that Agricola, in his “*De re metallica*,” published in 1558, speaks of them under this name, and also applies the name of *Trochites* (wheel-stones) to the separated ossicles of the stem. The *Encrinus liliiformis* from the Muschelkalk beds of Germany was for a long time considered the type of the class, and is still figured generally in geological manuals as a typical fossil of those beds. The name of *Encrinus* has been retained for the genus to which it was originally applied, and the name of *Pentacrinus*, by which Agricola distinguished

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those crinoids which have lost their arms, and thus show a quinquepartite radiate structure, has been equally fortunate in escaping the perils of early scientific nomenclature, though it is now applied to those crinoids which have a five-sided, as distinguished from a cylindrical, stem.

In 1669, Lachmund, in his "*Oryctographia Hildesheimensis*," published the first figure of a crinoid (*Encrinus liliiformis*), and was also the first naturalist who referred the stem and the detached ossicles of the stem to the same fossil as the calyx.

In 1673, M. Lister published in the Phil. Trans. of the Royal Society* the first illustrations of palæozoic crinoids, but, following the idea of his predecessors as to their vegetable nature, he fell into the amusing error of turning them upside down, and taking their arms to be roots.

Though many authors described fossil crinoids during the following half century, no nearer approach to their true nature was arrived at, the majority considering them petrified flowers or fruits, while a few supposed the stems to be the vertebræ of fishes.

In 1719, however, appeared a Latin work by M. R. Rosinus,† in which, for the first time, the animality of crinoids was demonstrated, and also their relation to starfishes. This work, therefore, marks an important epoch in the history of crinoids, and is further remarkable from the fact that it was not until thirty-six years afterwards that the first living crinoid (*Pentacrinus caput-Medusæ*) was discovered. Rosinus also confirmed the assertion of Lachmund that the detached ossicles of the stem belonged to the same class of animals.

In 1761, Guettard published, in the Memoirs of the Academy of Science of Paris, a paper bearing the date of 1755, in which he describes the first specimen of a recent crinoid which has been recorded (*Pentacrinus caput-Medusæ*). This specimen had been found at Martinique, in the West Indies, and is described under the name it had received on being found, that of *Palmier marin*, or sea palm. Guettard established the relation of this species with the fossil *Pentacrinini*.

The proper position of the crinoids in the animal kingdom,

* "A description of certain stones figured like plants, and by some observing men esteemed to be plants petrified." Phil. Trans., vol. vii., p. 6181.

† "Tentaminis de lithozois ac lithophytis olim marinis, jam vero subterraneis, prodromus : sive de stellis marinis quondam, nunc fossilibus, disquisitio." Hamb. 1719.

however, was still not yet universally admitted, and it is remarkable to find so acute an observer and careful systematist as Linnæus placing them among the corals, as Ellis* had done before the publication of Guettard's paper.

Lamarck† in 1801 and 1816 adopted the same view as Linnæus, in placing the crinoids among the *Polypes*, and this is the more remarkable as the specimen of *Pentacrinus caput-Medusæ* described by Guettard was at his service for reference in the Paris Museum.

Cuvier, in his "Règne animal," published in 1817, avoided the errors of his great predecessors, Linnæus and Lamarck, and placed the crinoids in their true position, calling them *Echinodermes pédicellés*, or stalked Echinoderms; and in 1821, J. S. Miller, a Bristol surgeon, published his classical work, in which, under the name of "*Crinoidea*, or lily-shaped animals," he gives a description of the structure of all the fossil crinoids known to him, and formulates a system of classification which has been the foundation of the work of all subsequent authors on this subject, and is a monument of the most careful and original study.

In the year 1823 occurs a very interesting chapter in the history of the crinoids, when Mr. J. V. Thompson,‡ a most ardent and observant naturalist, announced the discovery of a new recent species of crinoid, to which he gave the name of *Pentacrinus europæus*. Several examples of this animal were found in the Cove of Cork attached to zoophytes, and, though very small, being only three-quarters of an inch high, the discovery created a great sensation in the scientific world, as being the first specimens of a crinoid ever found in European seas, and as also being the first crinoid ever examined in a living state. Further examination, however, revealed the remarkable fact that this little crinoid was only in a larval state, and ultimately developed into the *Comatula rosacea*, or well-known feather-star of our seas. This was soon proved by Mr. Thompson's own observations, which were continued, with zealous care, from the ovum to the adult state of the animal. These subsequent observations modified the scope of the original discovery, and their importance was not fully appreciated until Darwin enunciated his doctrine of evolution, and this case proved an example of the truth of his law that the life history of the individual is the history of the development of its race.

* Phil. Trans., 1753.

† "Système des animaux sans vertèbres," 1801. "Histoire naturelle des animaux sans vertèbres, 1815-1822.

‡ "Memoir on the *Pentacrinus europæus*," Edin. Phil. Jour., 1827.

Within the last fifty years naturalists have devoted great attention both to fossil and recent crinoids, and though it must be a matter of regret that British palæontologists have not kept pace with their foreign *confrères* in this branch of geology, we may congratulate ourselves on the publication of the magnificent monograph, by Dr. P. H. Carpenter, on the crinoids dredged by the "Challenger" expedition during the years 1873-1876, which is a work unsurpassed both for its scientific importance and completeness, and the beauty of the illustrations.

Having thus imperfectly epitomised the history of the crinoids, for which I am chiefly indebted to De Koninck and Le Hou's "*Recherches sur les Crinoides du Terrain Carbonifère de la Belgique*" (1853), I will now speak briefly about the animals themselves.

As you are all aware, they are placed in the division, *Echinodermata*, in which they form a separate class, *Crinoidea*. The body of the animal is supported, generally, on a stem, which is most frequently fixed either in the ooze of the sea bottom, or to seaweeds, zoophytes, &c., by root-like cirri, or by an expansion of the base of the stem. The stem consists of a number of circular or pentagonal ossicles, which are articulated together, and have a circular, five-sided, or five-lobed orifice in the centre for the purpose of holding nervous and muscular fibres. In many species a number of prehensile cirri rise at intervals from the stem, thus serving to help the animal to anchor itself when in any current. At the top of the stem is a cup formed of numerous or few plates, which give off arms. These arms are sometimes simple; sometimes they divide into two parts, dividing again and again into a large number of fingers. These fingers and arms give off lateral pinnules, being all composed of calcareous plates, neatly articulated together. The soft parts of the animal are formed of a gelatinous integument which covers the whole skeleton, and which comprises the visceral and other organs, placed in the cup of the skeleton, and extending over the arms and pinnules. They possess a digestive canal with mouth and vent. The visceral organs are often protected by a disc of thin plates. The food is conveyed to the mouth by means of ciliated grooves in the interior of the arms. The marvellous complexity of the plates of the calyx and arms may be shown by the fact that in *Encrinurus liliiformis* they number upwards of 13,000, according to a calculation made by Mr. F. A. Bather, of the British Museum, who is now writing a series of papers on British Fossil Crinoids in the "*Annals and Magazine of Natural History*," and who estimates the number

of plates in the *Thenarocrinus callipygus*, a new species from the Dudley limestone, as 48,290.

Crinoids are gregarious in their habits, and frequently form vast colonies. Dr. Carpenter states that 10,000 have been brought up by a single haul of the dredge, and the swarms of *Extracrinus* that are found in the Lias beds of Lyme Regis, together with the innumerable stems found in the Derbyshire limestone, of which they form almost entire beds, testify that this habit was common to them in ancient geological periods.

They can live apparently only in clear water, and an influx of muddy water seems to be fatal to them. As an instance of this fact, I may say that a few years ago, in working the upper bed of limestone at Dudley Port, an immense number of crinoids were found, more than have been met with anywhere else in the district, lying on a thin seam of fine shale, intercalated with the crystalline limestone.

The food of the crinoids consists of foraminifera, diatoms and small crustacea, with the larvæ of larger ones, and I may mention, in this connection, that a serious mistake was made by former palæontologists in mistaking the anal tube for a proboscis or mouth; and Mr. J. W. Salter, in Murchison's "Siluria," gives an exaggerated figure of a *Marsupiocrinus* with the proboscis, as he calls it, inserted in the chamber of a gastropod, and, as he says, feeding on it. It is now known that the gastropod is feeding on the excreta of the crinoid, instances of which have also been met with on American fossil crinoids.

The geological range of the crinoids is very extensive, for specimens of stem joints are recorded from the Cambrian rocks, and they are distributed in subsequent formations in most countries. Though the recent crinoids affect mostly warm latitudes, and a sea depth less than 500 fathoms, they are capable of supporting existence apart from these two conditions, for Dr. Carpenter states that specimens of *Autedon* were dredged by the "Challenger" at a depth of nearly $3\frac{1}{2}$ miles in the Pacific Ocean, and at almost three miles in the South Sea; and that *Comatulæ* were found at from 81° N. to 52° S. latitude.

In conclusion, let me add that the fossil crinoids are among the fairest ornaments of the geologist's cabinet, and that Dudley is pre-eminent for the variety of species found in the Wenlock Limestone of that neighbourhood, and also for the wonderful state of their preservation, enabling the student to work out very successfully the minutest details of their marvellous structure.

HISTORY OF THE COUNTY BOTANY OF WORCESTER.

BY WM. MATHEWS, M.A.

(Continued from page 134.)

- * *Silybum Marianum*. 21, 47, Severn D. Tab. 17. In all the districts. In Lickey, extinct. *Not native*.
- * *Lapsana communis*. Tab. 17. In all the districts.
- * *Arnoseris pusilla*. 95, Pensham Field, Pershore. Nash, 1781. See "*Mid. Nat.*," Vol. X., p. 123. Extinct. Tab. 17. Avon. Gathered by Dr. F. Arnold Lees, "on the bank of the Bewdley Branch Railway at Kidderminster, east of viaduct, June 30th, 1883."
- * *Cichorium Intybus*. 13, near Stourport; 47, various places near Worcester; 93, near the Trench Woods. Tab. 17. Avon, Severn, Malvern.
- * *Hypochæris glabra*. 11, 13, 60, Hartlebury Common; 66, North Hill, Malvern; 95, Pensham Field, Nash (extinct). Tab. 17. Avon, Severn, Malvern.
- * *H. radicata*. In all the districts.
- * *Thrinchia hirta*, *Apargia hispida*, *Oporinia autumnalis*. Tab. 17. In all the districts.
- * *Tragopogon minor*, including *pratensis*. 47, Severn D. Tab. 17. In all the districts.
- T. porrifolius*. Tab. 17. Lickey. Not localised.
- * *Picris hieracioides*. 67, Silurian eminences of Malvern.; 93, Cracombe Hill, &c.; 132, Dudley. (*Randan Woods, Wm. M.*) Tab. 17. In all the districts.
- * *Helminthia echioides*. 46, Severn D.; 63, Silurian eminences of Malvern. 93, Avon D.; 133, Dudley. Tab. 17. In all the districts.
- * *Lactuca saligna*. Tab. 17. Severn, extinct. *Not localised*. The first record for this plant is in *Merrett's Pinax*, as growing in Church Lench, in the Avon district. See "*Mid. Nat.*," Vol. X., p. 88.
- †* *L. virosa*, lxi. 13. "On Mr. Bree's authority in Purton's "*Midland Flora*," but unconfirmed by any member of the club." But Purton writes, "*Midland Flora*," Vol. II., p. 372, "Roadsides, Stonebridge, Bree." *This locality is in Warwick. See Bagnall's "Flora of Warwickshire," p. 164.* Nevertheless contributed by Mr. Lees to Watson's "*New Botanist's Guide*," without locality. See "*Mid. Nat.*," Vol. XI., p. 279.
- * *L. Scariola*. 68, 73, Longdon Hill End. Tab. 17. Malvern.
- * *L. muralis*. 48, 93, 104, 130. Table 17. In all the districts.
- * *Leontodon Taraxacum*. Tab. 17. In all the districts.
- * *Sonchus oleraceus*, *asper*, *arvensis*. Tab. 17. In all the districts.
- * *Crepis virens*. 48. Tab. 17. In all the districts.
- * *Hieracium Pilosella*. Tab. 18. In all the districts.
- * *H. murorum*. 48, Severn D.; 123, Uffmoor Wood, Dales Wood! Tab. 18. In all the districts. *Very local. Locally abundant in Wyre Forest!*

- * *H. vulgatum*. 48, Severn D. ; 100, Avon D. Tab. 18. In all the districts.
- * *H. umbellatum*. 6, 13, 48, Severn D. Tab. 18. In all the districts.
I have only seen this plant in the Severn district.
- * *H. boreale*. 6, 48, Severn D. Tab. 18. In all the districts.
- * *Jasione montana*. 48, 59. On sandstone. Severn D. 115, Lickey. Tab. 18. Severn, Malvern, Lickey.
- * *Campanula glomerata*. 100, 103, 105, Avon D. 135, Dudley Castle. Tab. 18. Avon, Lickey.
- * *C. latifolia*. 13, 18, 48, Severn D. 72, Malvern. 97, Avon. 121, 123, 124, 126, Lickey. Tab. 18. In all the districts.
- * *C. Trachelium*. 48, Severn D. 72, 86, Malvern D. 105, Avon. Tab. 18.
- * *C. Rapunculoides*. 22, near Droitwich. Tab. 18. Avon, Severn, Lickey. *Not native.*
- * *C. rotundifolia*. Tab. 18. In all the districts.
- * *C. Rapunculus*. 135, Malvern D. *Not localised.* Tab. 18. Severn, Malvern. *Not localised in either district.*
- * *C. patula*. 6, 13, 18, 19, 48, various places in Severn D. Tab. 18. In all the districts.
- C. Speculum*. 106, field on Bredon Hill. Miss Woodward. Tab. 18. Avon. *Not native.*
- Specularia hybrida*. 48, Severn D. 100, 103, Avon D. Tab. 18. Avon, Severn, Malvern. *First record.*
- * *Wahlenbergia hederacea*. 11, 13. Recorded as found by the late Rev. T. Butt, rector of Oddingley, on Hartlebury Common many years ago. Tab. 19. Severn, extinct.
- * *Calluna vulgaris*. 10, 17, 48, Severn D. ; 112, 113, 115, 138. Tab. 19. In all the districts.
- * *Erica Tetralix*. 13, 17, 48, 59, Severn D. ; 113, 119, Lickey D. Tab. 19. Avon, Severn, Lickey.
- * *E. cinerea*. 13, 48, 59, Severn D. ; 112, 113, 115, 119, Lickey D. Tab. 19. Severn, Lickey.
- * *Vaccinium Myrtillus*. 13, 59, Severn D. ; 63, Malvern ; 112, 115, 138, Lickey. Tab. 19. Severn, Malvern, Lickey.
- * *V. Oxycoccus*. 15, 129, formerly on Pedmore Common, Scott ; 114, formerly at the Lickey ; 119, formerly in the bog on Moseley Common. Extinct. Tab. 19. Lickey, extinct.
- * *Pyrola media*. 5, 6, Wyre Forest ; 15, 130, formerly at Cradley Park, Scott. Tab. 19. Severn, Lickey. Extinct.
- * *P. minor*. 5, 6, 18, Wyre Forest. Tab. 19. Severn.
- * *P. rotundifolia*. 59, Wyre Forest. *Probably an error. Not in table.*
- * *Monotropa Hypopitys*. 6, Warshill, near Bewdley ; 102, 103, Middle Hill, Broadway ; Sir Thomas Phillipps, "Many years ago ;" 1855, Mr. W. Cheshire. Tab. 19. Avon, Severn. Extinct.
- * *Ligustrum vulgare*. 5, 48. Tab. 19. In all the districts.
- * *Fraxinus excelsior*. Tab. 19. In all the districts.

- * *Vinca minor*. 48, base of Cruckberrow Hill, &c.; 68, 86, Malvern D. Tab. 19. Severn, Malvern.
- * *Vinca major*. Tab. 19. In all the districts. *Not native*.
- * *Chlora perfoliata*. Tab. 19. In all the districts.
- * *Erythræa pulchella*. 135. Tab. 19. Malvern.
- * *E. Centaurium*. Tab. 19. In all the districts.
- * *Gentiana Amarella*. 6, Trimpley; 68, Malvern; 93, 98, 101, 104, Avon D.; 133, Dudley. Tab. 19. In all the districts.
- * *G. campestris*. 5, 6, 59, Wyre Forest. *Unlocalised. Assumed to be in Worcester.* Tab. 19. Severn.
- * *Villarsia nymphæoides*. 91, in the Avon, near Eckington. Tab. 19. Avon.
- * *Menyanthes trifoliata*. 11, 13, Hartlebury Common; 60, pools between Churchill and Hagley; 119, formerly at Moseley. Tab. 19. Severn, Malvern, Lickey.
- Polemonium cæruleum*, xxx. Bromsgrove. *Not native*.
- * *Convolvulus arvensis*. Tab. 19. In all the districts.
- * *C. sepium*. Tab. 19. In all the districts.
- * *Cuscuta europæa*. 95, Badsey, near Evesham. Tab. 19. Avon, Severn, Malvern.
- C. Epilinum*. 24, Tibberton, near Worcester. Tab. 19. Severn, Malvern. *Not native. First record.*
- * *C. Epithymum*. 93, Cracombe and Coldknap Hills, near Evesham. Tab. 19. Avon.
- C. Trifolii*. 24, near Alderminster. Tab. 20. Avon. *Lickey, W. M.! Probably in other parts of county. Not native. First record.*
- * *Solanum nigrum*. Tab. 20. In all the districts.
- * *S. Dulcamara*. Tab. 20. In all the districts.
- * *Atropa Belladonna*. 111, 132, Dudley. Tab. 20. Severn, Lickey.
- * *Hyoscyamus niger*. 6, 21, Severn; 98, Alderminster; 101, Bredon Hill; 130, Cradley Churchyard, Thompson; Additions and Corrections, Castle Morton, Elmley Castle. Tab. 20. In all the districts.
- * *Datura Stramonium*. 21, Severn. Tab. 20. Avon, Severn, Malvern. *Not native*.
- Nicotiana rustica*. 21, naturalised about Bewdley, Jorden. *Not in table.*
- * *Verbascum Thapsus*. Tab. 20. In all the districts.
- * *V. Lychnitis*. 13, 60, near Wolverley, and profusely near Cookley. Tab. 20. Severn.
- * *V. nigrum*. 9, 13, 49, 60, sandy places in the Severn district. Tab. 20. Severn, Lickey.
- * *V. Blattaria*. 95, S. Littleton, Purton. Tab. 20. In all the districts.
- * *V. virgatum*. 9, 13, High Habberley; 21, Bevere; 60, sandy places in Severn district. *Brake Plantation, Hagley, W. M.!* Tab. 20. Severn, Malvern. *Extinct.*
- * *Digitalis purpurea*. Tab. 21. In all the districts.

- * *Antirrhinum majus*. 23, 49, old walls at Worcester, &c. Tab. 21.
Avon, Severn, Malvern. *Not native*.
- * *A. Orontium*. 13, 49, Severn D. Tab. 21. Severn, Malvern.
- * *Linaria Cymbalaria*. 23. Tab. 21. In all the districts. *Not native*.
- * *L. Elatine*. 49, calcareous field at Tibberton; 93, 94, 106, Avon D. Tab. 21. In all the districts.
- * *L. spuria*. 49, calcareous field at Tibberton; 93, 94, Avon D. Tab. 21. Avon, Severn, Malvern.
- * *L. minor*. 68, Malvern, on the limestone; 97, 100, 101, Avon D. Tab. 21. Avon, Severn, Malvern.
- * *L. vulgaris*. Tab. 21. In all the districts.
L. repens, xxx. Road side near Mitre Oak, T. Westcombe. *Not in table. Not native. Clent Hill, Mr. Amphlett! 1883.*
- * *Scrophularia nodosa*. Tab. 21. In all the districts.
- * *S. aquatica (Balbisii)*. Tab. 21. In all the districts.
S. Ehrharti. 69, 73. *A misnomer, see corrections at end of volume. Discovered by Mr. R. F. Towndrow in several localities in the Severn and Malvern districts.*
- * *Limosella aquatica*. 65, 73, Malvern Chace; 95, Badsey; 131, pools near the Heath, Stourbridge, Scott. Tab. 21. Avon, Malvern, Lickey.
- * *Melampyrum cristatum*. Tab. 21. Extinct. *Not in text. Un-localised.*
- * *Melampyrum pratense*. 72, Malvern. Tab. 21. In all the districts.
Mimulus luteus, xxx. Once gathered, but memorandum of spot mislaid. *Streams about Blakedown and Churchill. W. M. !*
- * *Pedicularis palustris*. 91, near Pershore; 119, formerly at Moseley. *Wyre Forest, 1858, W. M. !* Tab. 21. Avon, Severn, Lickey.
- * *P. sylvatica*. In all the districts.
- * *Rhinanthus Crista-Galli*. Tab. 21. In all the districts.
- * *Euphrasia officinalis*. Tab. 21. In all the districts.
- * *Bartsia Odontites*. Tab. 21. In all the districts.
- * *Veronica scutellata*. 13, Hartlebury Common; 49, near Worcester; 119, formerly at Moseley. Tab. 21. In all the districts.
- * *V. anagallis*. Tab. 21. In all the districts.
- * *V. Beccabunga*. Tab. 21. In all the districts.
V. spicata, xxx. Near the Severn, above Worcester, Mr. T. W. Gissing. *Not native to Worcester. Not in table.*
- * *V. Chamædrys*. Tab. 21. In all the districts.
- * *V. montana*. Tab. 21. In all the districts.
- * *V. officinalis*. Tab. 21. In all the districts.
- * *V. serpyllifolia*. Tab. 21. In all the districts.
- * *V. arvensis*. Tab. 21. In all the districts.
- * *V. agrestis*. Tab. 21. In all the districts.

(To be continued.)

THE FUNGI OF WARWICKSHIRE.

BY W. B. GROVE, M.A., AND J. E. BAGNALL, A.L.S.

(Continued from page 138.)

591. *S. spadiceum*, *Fr.* On stumps and fallen branches. Sutton; Sutton Park; New Park, Middleton; School Rough, Marston Green.
592. *S. sanguinolentum*, *Fr.* Woods. Near Warwick, *Perceval*. On logs, Sutton Park; Driffold Lane; Edgbaston; Trickle Coppice; Coleshill Pool.
593. *S. rubiginosum*, *Fr.* *Auricularia ferruginea*, *With.* Edgbaston, *With.* 335. Near Warwick, *Perceval*. Shustoke; Driffold Lane, Sutton.
594. *S. tabacinum*, *Fr.* *Auricularia*, *Purt.* Oversley Wood, *Purt.* iii. 260.
595. *S. rugosum*, *Fr.* On stumps. Warwick, *Perceval*. Driffold Lane, Sutton; Coleshill Heath; Earlswood Reservoir.

Genus XXX. AURICULARIA. *Bull.*

596. *A. mesenterica*, *Fr.* On trunks of trees. August to March. Warwick, *Perceval*. On felled timber, Red Lane, Kenilworth, *Russell*, *Illustr.* Hopsford, *Adams*. Kingsbury, *Hawkes!* On old stumps near Upper Eaton, April, 1883; Sutton Park; Shustoke, &c.

Genus XXXI. CORTICIUM. *Fr.*

597. *C. evolvens*, *Fr.* Warwick Castle timber yard, *Perceval*. Sutton Park; Edgbaston Park.
598. *C. giganteum*, *Fr.* August. Sutton Park, on larch.
599. *C. læve*, *Fr.* Sticks, &c. Common. Sutton Park; New Park; Shawberries Wood; Hartshill Hayes, &c.
600. *C. sanguineum*, *Fr.* Bentley Wood, *Bloxam*. On oak chips, Lady Wood, Four Oaks, October, 1888.
601. *C. cæruleum*, *Fr.* On rails. Near Warwick, *Perceval*, March, 1872.
602. *C. quercinum*, *Fr.* On trees. September - October. Sutton; Sutton Park; Solihull; Olton Reservoir; Edgbaston Park.
603. *C. cinereum*, *Fr.* On dead branches. Oscott; Sutton; Edgbaston Park; Packington Park; Olton Reservoir; Spennall.
604. *C. incarnatum*, *Fr.* September. Sutton Park; Windley Pool; Driffold Lane; Middleton; Hampton-in-Arden.

605. *C. nudum*, *Fr.* On branches, even of living trees. Warwick, *Perceval*. On lilac, Sutton; Shustoke.
606. *C. corrugatum*, *Fr.* On fallen twigs. Driffold Lane, Sutton, January-February, 1883.
607. *C. comedens*, *Fr.* On dead branches. August to October. Solihull; Edgbaston Park; Packington Park.
608. *C. puteanum*, *Fr.* Warwick, *Perceval*. In a well, Edgbaston, *C. B. Caswell!* Fillongley, *Adams*.
609. *C. aridum*, *Fr.* On damp wood. Driffold Lane, Sutton; Four Oaks,
610. *C. terrestre*, *Mass.* Amongst decaying leaves. School Rough, Marston Green.
611. *C. sambuci*, *Fr.* On elder. December-January. Driffold Lane, Sutton.

Genus XXXII. CYPHELLA. *Fr.*

612. *C. capula*, *Fr.* On dead herbaceous stems. May to October. Driffold Lane, Sutton; Solihull; Dunchurch. A yellowish form is occasionally met with.
613. *C. Curreyi*, *B. et Br.* On bark, Erdington, June, 1883.
614. *C. faginea*, *Lib.* On a dead stump, Bradnock's Marsh, July, 1884.
615. *C. villosa*, *Pers.* On a dead stem of *Rumex*, Edgbaston, August, 1883. Comparative figures of the three last species will be found in Bucknall's "Fungi of the Bristol District," part v., pl. 2., figs. 1-3. They are probably all immature stages of *Peziza*.

ORD. V.—CLAVARIEI.

Genus XXXIII. CLAVARIA. *Linn.*

616. *C. fastigiata*, *Linn.* Pastures. September-October. Coleshill Heath! *Bree*. Between Oversley Turnpike and Haslor, *Purt.* iii. 269. Shilton Fields, *Adams*. Middleton Heath; Langley.
617. *C. coralloides*, *Linn.* *C. muscoides*, *Purt.* Sept.-Oct. Oversley Wood, *Purt.* ii. 698. Langley, 1883.
618. *C. cinerea*, *Bull.* In woods. August to October. Combe Woods, *Adams*. New Park, Middleton; Trickley Coppice; Windley Pool, Sutton; Solihull.
619. *C. cristata*, *Pers.* Woods. August to October. Warwick, *Perceval*. Coleshill Pool; Trickley Coppice; Bradnock's Marsh; Shirley Street; Olton Reservoir; Edgbaston Park.

620. *C. rugosa*, Bull. *C. coralloides*, var. 2, *elegans*, Purt. October. On a hedge bank at Salford, and at Dunnington; in a sandy soil, *Purt.* iii. 269. Combe Woods, *Adams.* Trickley Coppice.
621. *C. Kunzei*, Fr. Woods. Rare. August. Lodge Wood, Warwick, *Perceval.*
622. *C. fusiformis*, Sow. Woods. October. On an elm at Sambourn, *Purt.* ii. 698. Kenilworth, *Russell, Illustr.* Hopsford, *Adams.*
623. *C. inæqualis*, Fl. Dan. October. Combe Ridings, *Adams.* Sutton Park. The var. *aurantiaca*, Pers., in Sutton Park and on Coleshill Heath.

(To be continued.)

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—BIOLOGICAL SECTION. July 14th. Mr. R. W. Chase in the chair. Mr. A. J. Parker exhibited a nest of marsh-tit (*Parus palustris*), built in a branch of a birch tree, and a nest of tom-tit (*Parus cœruleus*), built in a box, the birds having forsaken it after laying one egg. Mr. Steele Elliott exhibited a nest of hawfinch (*Loxia coccothraustes*) with a clutch of four eggs, from Sutton Park; a nest of missel thrush (*Turdus viscivorus*), with eggs, also from Sutton Park, the foundation of nest being built with strips of paper. A clutch of eggs of magpie (*Corvus pica*), amongst which a kestrel (*Falco tinnunculus*) had also placed an egg, from Bedfordshire. A photograph of a couple of young peregrine falcons (*Falco peregrinus*) from Donegall, and a stuffed pair of stormy petrels (*Procellaria pelagica*), also from Donegall. Mr. T. V. Hodgson exhibited a mole cricket from Lucerne, and a photograph of nests of four species of birds.

OXFORD NATURAL HISTORY SOCIETY.—On July 9th, an excursion was made to Watlington and neighbourhood by ten members of the above society. They left Oxford by the 8-25 train, and were joined at Princes Risborough by some friends from the neighbourhood. Mr. E. B. Poulton, F.R.S., gave a short address on the geology of the district, in which, with the help of a geological map, he clearly explained the arrangement of the successive strata, the overlapping of the greensand by the chalk, and the significance of the chalk "outliers." At Aston Rowant Station, the party was met by the Rev. J. W. B. Bell, of Pyrton Vicarage, and various members of the Chiltern Society of Naturalists. Beacon Hill (access to which was granted for the occasion) was explored, and several interesting specimens of the flora of the chalk country were observed, notably—the *Orchis conopsea*, two species of *Epipactis*, a rare species of *Rubus*, the *Pyrola minor*, or winter green, and the *Veronica montana*, chiefly near the old Saxon road, called Icknield Way. After having visited Shirburn Castle, the company were entertained at Pyrton Vicarage, by Mr. and Mrs. Bell, and returned to Oxford by the 5-45 p.m. train.



A COTTAGE IN THE JUNGLE.

BURMA AND ITS PEOPLE.*

BY A. W. WILLS.

Farther India is not yet overrun by personally conducted tours, and not much frequented by the British globe-trotter.

I have observed that many people are possessed by a rooted belief—derived, I believe, from the communications of the Rangoon correspondent of the *Times*—that it is principally inhabited by bands of desperate criminals, called Dacoits; and that their knowledge of the country does not extend far beyond this supposed fact.

It seemed to me, therefore, that, having visited Burma under circumstances which enabled me to get more into touch with its people than is possible to those who travel there under less fortunate conditions, I should be guilty of something approaching to a dereliction of duty if I failed to respond to your invitation to communicate to you some of the impressions which my wife and I derived from our recent sojourn in that sunny land.

Were our time less limited, I would ask you to linger with me awhile on the way thither, in the beautiful island of Ceylon, to wander among the depths of its primeval jungles and under the shade of its palms, to breathe the balmy air of its cinnamon gardens and to admire the splendour of its flora and the thousand charms with which nature has clothed its length and breadth. But I have asked you to travel with me to-night not to Ceylon, but to Burma.

You must suppose that we have already escaped from the heat of the Red Sea, passed the grim rocks of Perim, landed our mails at Aden (where, according to the popular saying, only a sheet of paper separates you from the nether regions, and *that* is scorched), and set foot once more on terra firma among the Cocoa palms of Colombo. Please imagine, too, that we have spent a delightful fortnight with old friends among the mountains, of which Adam's Peak is the best known, though by no means the highest, and then re-embarked and steamed on through the Bay of Bengal to Calcutta, where we have finally transferred ourselves and our impedimenta to the British India Company's ship "Bundara."

* Read before the Birmingham Natural History and Microscopical Society, December 2nd, 1890.

This is a change from the sweetness and luxury of the big P. and O. vessel on which we have come out, for it is only a ship of 3,000 tons, and 600 coolies are crowded on the deck, and out of this number about 400 are, at any time of day or night, smoking their hubble-bubbles, a kind of primitive hookah, charged with a mixture in which tobacco, opium, and Indian hemp are choicely blended with a much larger proportion of dried cow manure, and the effluvium makes food a disgust, and sleep an impossibility.

Happily, it is but a four days' run to Rangoon.

Long before you reach that port the deep sapphire of the open ocean changes to a brownish hue, proclaiming that you are abreast of the mouths of the mighty Irrawaddy, which, after flowing south for 800 miles, pours its waters into the sea by a network of outlets spreading out over 100 miles of coast line.

At last the ship enters the principal channel, between low banks dotted with villages and fringed with tropical trees, and after a few hours the golden spire of the great Pagoda of Rangoon is seen, towering high above surrounding palms, against the cloudless sky.

Then we run alongside the landing-stage, and, amid prodigious clamour and bustle, join hands with those dear ones whom we have journeyed so many leagues to see face to face once again.

Rangoon is a city of some 200,000 people. In its commercial quarter great bazaars, lofty warehouses and imposing public buildings stand in juxta-position with the bamboo shanties of the native population; and in the streets, Burmese, Tamuls, Bengalees, Madrasees, Chinamen and English mingle in a medley of costumes and a Babel of tongues.

The cantonments of the British garrison and the bungalows of the European residents stand on high ground a couple of miles behind the city, in an environment of palms and other stately trees which make the situation eminently picturesque,

But the glory of Rangoon is its great Golden Pagoda, the Schway Dagon. What the sacred city of Benares is to the Hindoo, the shrine of the Prophet at Mecca to the Mahomedan, St. Peter's at Rome to the devout Roman Catholic, such is the Schway Dagon to the pious Buddhist of Ceylon, Burma, or Siam, and to see it once in his life is his heart's desire.

This wonderful building stands, surrounded by noble trees, on a lofty, square, artificial platform, and is approached by four long flights of steps from the four quarters of the compass. Let us approach it by the principal or eastern one, a broad series of stone stairs, steep and worn by the feet of countless pilgrims into almost dangerous roundness, 20 feet wide, and some 200 yards long, rising in that distance to the level of the central plateau, and covered the whole way by a roof supported by teak pillars.

Entering by a lofty archway of grotesque design, in which strange dragon-like forms prevail, you find yourself at once in this covered way, which is extended on either side into a series of platforms. On these stand numerous rest-houses and booths for the sale of rice, cakes, sugar-cane, and other comestibles, native books, cigars, candles and gold-leaf for votive offerings, and a host of other trifles.

The first object which attracts your notice is a row of mendicants, halt, blind, maimed, lepers, who hold up their alms-bowls for pice as you go by, but do not curse you if you fail to respond to their silent appeal to your pity.

Arrived at the top of the great flight of steps, you find yourself in a square of some 350 yards each way, the centre of which is occupied by a vast mass of masonry, flanked by scores of huge figures of elephants, standing and couchant, and of strange dragon-like beasts of quaint and formidable aspect, the whole resplendent with gold and vermillion.

Behind these the square base of the Pagoda is ramped off in tiers of masonry, and from the middle of it rises the enormous spire, gracefully swelling out below, and sweeping upward in fine curves to a height exceeding that of the ball of St. Paul's, and gilt from base to summit, where it is capped by a Htee (pronounced Tee), an appendage shaped somewhat like a half-closed umbrella, adorned with jewels and hung with innumerable sweet-toned bells, which sway with every breath of wind, and fill the air with their melodious tinkling. This Htee was the gift of the late King Theebaw in 1871; it contains the largest ruby in the world, and is valued at fully £50,000.

In the middle of each of the four sides of the pagoda-base is a large temple, in which pilgrims are ever burning candles, telling their beads, and repeating their prayer formulæ before images of the Buddha. Finally, parallel with these four sides, and separated from them by a broad paved terrace, is a quadrangle of closely-packed buildings, the work

of pious devotees, each of which contains images of the Buddha in alabaster, wood, or bronze, of all sizes from one foot to thirty feet in height, many of them richly ornamented with gold and vermillion, and amounting in all to many hundreds.

The interior of some of these annexes is adorned with pictures of Gautama's miracles, such as the cure of persons afflicted with loathsome diseases, or the resuscitation of others who have been hewn into pieces, depicted with very unpleasant realism; but in many of these drawings accessory landscape is rendered with admirable perception of the forms of tropical life, both animal and vegetable.

To complete the scene, picture to yourselves the Buddhist yellow-robed monks moving to and fro, or surrounded by pupils, to whom they are expounding their doctrines; pilgrims of many races and in many-hued garments passing in and out of the shrines or pacing round the great terrace with hands outstretched and fingers joined at the tips in silent devotion; astrologers, with their mystical "properties," surrounded by eager listeners; worshippers dotted about here and there in the great open space, repeating their forms of prayer in monotonous nasal tones. Remember that many of these have travelled from distant Siam or from the hills of Upper Burma, men, women, and children of manifold ethnological types and in diverse costumes; observe how some are carrying before them books of gold-leaf fixed in cleft sticks, and are ever and anon performing an act of piety by affixing a piece to some part of the building; and how quiet, clean, well clad they are, and in what evident earnest.

Picture to yourselves these shrines, with their doorways and roofs all adorned with magnificent, deeply-undercut carving in teakwood, in which conventional designs, based on plant forms, are mingled with spirited figures of men and beasts, and the whole scene full of life, movement, and colour; and lastly, imagine the great Pagoda itself, golden from base to top, resplendent in full blaze of tropical sunlight, and standing out against a sky of cloudless blue, and the whole scene set amidst the graceful foliage of palms, giant bamboos, and forest trees, and you will scarcely wonder that I look upon our visits to the Schway Dagon as among the events of our lives.

Twice did we see it: once in the glory of dazzling sunlight; once again by the light of the full moon, when its carved roofs and doorways, its innumerable quaint sculptures, and its countless calm-faced Buddhas were invested with a

mysterious solemnity which stimulated the imagination in the highest degree.

Before going further, I ought to say a few words in regard to Buddhism and its brotherhood of Monks, to whom I shall have so often to refer under their Burmese title of Hpoongyees (pronounced Poongis). Our personal intercourse with these men was very agreeable, and the religion, which is the faith of at least 100 millions of our fellow-men, is certainly worth a moment's consideration. I shall speak of it, of course, purely in its historic aspect.

Gautama, the Buddha, lived about the fifth century B.C., say twenty-four centuries ago, and was born not far from Benares, the son of a powerful land owner. Four miraculous visions, so the legend runs, led to his renunciation of the pomps and vanities of the world ; and, going to his father, he said, "I wish to become a wandering ascetic, for all worldly things are transitory and vain." He was about to enter upon his ascetic career when Mara appeared to him, that evil deity who tempts men to indulge their animal passions, and promised him the glories of empire if he would but return to the pleasures of a worldly life. Resisting the tempter, Gautama fled from his father's domain, exchanged garments with a beggar, and became a thorough ascetic. Attaching himself as a disciple to the Brahmans, he found *their* pantheistic philosophy valueless ; six years of fasting and self-mortification convinced him again of the insufficiency of *this* form of spiritual discipline. Finally, he gave himself up to prolonged meditation under a sacred fig-tree, and there resisted once more the attacks of Mara and his thousand demons ; at the end of a night of horrors the light of true knowledge dawned upon him, and after twenty-eight days of blissful self-abstraction he went forth to preach the new doctrine with which he had been illuminated. Soon a few disciples gathered round him to form his first brotherhood, and from this nucleus arose that vast religious system which, radiating from this central point, spread first over all India and thence over most of Eastern Asia.

The cardinal principles of this faith are that all life involves pain and suffering, and that all suffering is caused by the craving for sensual pleasures, wealth, and *personal existence*. By long meditation and suppression of self, all earthly desires may be finally extinguished ; and by these means the Buddhist hopes, after death, to arrive at one of the many higher stages of being, through which he must pass in succession before he

reaches the final consummation of Nirvāna, in which state he will for ever attain perfect repose and *cessation from all personal consciousness*. But if he fails in this extinction of earthly desires, he may relapse into one of the lower forms through which he has already passed, or even be re-born into one of the 136 divisions of hell, where he must pass at least 500 years, of which each day equals fifty earthly years, after which lengthy purgation he may be re-born once more into a better state.

The Buddha's fraternity was a monastic communism in which all were bound by certain obligations of celibacy, poverty, and mutual confession, but it was not in any true sense a priesthood, and its vows were and are not ever irrevocable.

Personal extinction was the *summum bonum* of its religious aspirations, and the brotherhood was to become co-extensive with the whole world.

The elaborate hierarchy of Thibet, with its Llamas, bishops, and orders of priests is a gross corruption of the Buddha's system, and it is in Burma that the latter still retains most of its primitive simplicity. A knowledge of the facts which I have summarised in a few words will, I think, enable my friends to follow with greater interest such portions of my further discourse as refer to the Burmese Hpoongyees and the Kyoungs or dwellings of their brotherhoods.

On leaving Rangoon by the line of railway which now connects that port with the ancient capital of Mandalay, and will shortly be extended to Bhamo and ultimately connected with the Indian lines in Assam, you pass through very varied scenery. For perhaps fifty miles together you travel through dense jungle where forest trees shut out the noonday sun; occasionally you emerge into open tracts where thousands of acres are cultivated with paddy by a system of laborious irrigation; once more you plunge into the depths of the forest and yet again pass into a region where, at intervals, clusters of native dwellings stand buried among plantains and cocoa and Palmyra palms, while here and there the bungalows of European residents indicate a British station.

A cottage in the jungle is shown in Plate 9.

Orchids hang in thousands from the branches of the trees, and now and again a tinge of colour among the topmost boughs proclaims that the gorgeous *Vanda teres* is in bloom; giant creepers and lianas clasp the tree trunks or hang in

graceful curves from branch to branch; the undergrowth, even now in the depth of winter, when the temperature does not exceed 85° in the shade, is rich with flowers of leguminous shrubs, convolvuli, and many species of Cucurbitaceæ; while in the swamps immense grasses, twelve or fifteen feet high, shine in the sunlight like molten silver.

Bamboos and calami add the matchless gracefulness of their forms to the ever-varying charm of the scene.

Nor is animal life wanting to enliven it. Blue jays, black butcher-birds, mynahs, snow-white paddy birds, swallows, and gorgeous green parrots flit to and fro, and great flocks of pelicans feed in the marshes or wheel in grand circles, with huge, outstretched wings.

Buffaloes and bullocks are frequent in the fields, the former drawing primitive wooden ploughs through the mud which, in a few days, will be verdant with the young paddy plant; the latter as the universal beast of burden of the country.

(To be continued.)

THE MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

ANNUAL MEETING, 1891.

The Dudley and Midland Geological and Scientific Society have this year invited the Union to hold its annual meeting at Dudley, and all who were privileged to join the excursion forming part of the arrangements at the first annual meeting of the Union, held at Birmingham in 1878, will remember the visit to Dudley, which was the best attended and one of the most interesting excursions ever arranged for by any of the affiliated societies. On that occasion more than four hundred ladies and gentlemen met at Dudley and spent a most enjoyable day. The arrangements were made by the Dudley Society, and the programme on that occasion included a visit to the Open Coal Working at

Foxyards, where the Ten-yard Coal Seam exposes its point of outcrop on the east side of the obtruding ridges of Dudley Castle Hill and the Wren's Nest. Mr. Thomas Latham (the then mine agent of the Earl of Dudley) gave the visitors interesting information as to the mode of getting the coal, and, under his direction, a large fall of coal was displayed. The visitors then proceeded to the Wren's Nest Hill, and inspected the "Daylight Caverns." The Priory Ruins were next inspected; and then a visit was made to the celebrated Silurian caverns (which were illuminated for the occasion), and afterwards to Dudley Castle. Luncheon followed next, and then came the crowning event of the day—the descent by more than four hundred persons, including many ladies, of the famous Lye Cross Coal Pit at Rowley. No one present on that memorable occasion will ever forget it, or the courteous attentions they received from the Earl of Dudley's representatives.

The forthcoming visit to Dudley will be on somewhat different lines. The Dudley and Midland Geological and Scientific Society will on this occasion make all the arrangements for the entertainment of members of the Midland Union, whereas in 1878 they co-operated with the Birmingham Natural History and Microscopical Society. The programme is not yet fully arranged, nor is the exact date fixed; all we know at present is that the meeting will occur some time in October, and that the Dudley Castle Caverns will (through the kindness of the Right Hon. the Earl of Dudley) be illuminated in a most efficient manner. As soon as the final arrangements are made, copies of the official programme will be sent to the various secretaries of the Societies in the Union for distribution among the members. Mr. W. Madeley, Martin's Hill House, Dudley; and Dr. Lawson Tait, The Crescent, Birmingham, will, either of them, answer enquiries as to the forthcoming annual meeting.

ON A BORING AT SHILLINGFORD, NEAR WALLINGFORD (ON THAMES).

BY A. J. JUKES BROWNE, B.A., F.G.S.

The site of this boring is at Mr. Field's Brewery at Shillingford, a small village on the Oxford side of the Thames, two miles north of Wallingford, and about ten miles south-east of Oxford. Thus, although the boring is outside the limits of the London basin, it is in the valley of the Thames, and has a certain bearing on the subterranean geology of the London basin, inasmuch as it is at present the nearest point west of Richmond where the Lower Greensand in its normal facies has been proved to exist.

The results of the boring are, in fact of interest, on two accounts :—(1) It enables us to ascertain the thickness of the several formations which lie between the Malmstone Beds of the so-called Upper Greensand and the Oxford Clay at a point which is eight-and-a-half miles from the nearest outcrop of the latter ; (2) it is remarkable for having passed through two water-bearing deposits without having obtained a satisfactory supply from either, though both are strata from which such a supply was to be expected.

The boring operations were conducted throughout by Messrs. Isler and Co., to whom, and to Mr. Field, I am indebted for the information on which this communication is based.

The work was commenced in 1885, and the boring was rapidly carried through the Gault into the Vectian (Lower Greensand), where a plentiful supply of water was found, but unfortunately it contained so much sodium chloride as to be unfit for use. When the boring had reached the Kimeridge Clay, Messrs. Isler applied to the Geological Survey for information as to the probability of obtaining a better water supply at a greater depth. They were informed that the thickness of the Kimeridge Clay would probably be between 100 and 150ft., and that after passing through a certain thickness (possibly 20ft. or 30ft.) of limestone, a good supply of water might reasonably be expected from the sands which would occur below, if the succession was the same as that on the outcrops about eight miles distant.

On the strength of this opinion, boring was recommenced in March, 1886, and continued till at a depth of 375 feet sand was reached, and water found, which, however, did not rise further than to 60ft. below the surface. Moreover, the sand was only a thin bed, and at 379½ft. the tools entered a dark

grey clay which could only be regarded as Oxford Clay, so that it was considered useless to proceed any further.

The following is a detailed description of the boring, drawn up partly from the information given by Messrs. Isler and Co., and partly from specimens seen at various times during the progress of the work:—

						Thickness.		Depth.	
						Ft.	In.	Ft.	In.
						4	0	4	0
						15	0	19	0
Gault 144ft.	{	Grey clay				81	0	100	0
		Darker grey clay				63	0	163	0
Vectian or Lower Greensand, 25ft.	{	Yellowish greensand with quartz pebbles				10	0	173	0
		Hard sand rock				4	0	177	0
		Greensand and pebbles				6	0	183	0
		Greensand, loamy				1	0	184	0
		Loose pebbly sand, with grains as large as peas				2	9	186	9
Kimeridge Clay, 111½ft.	{	Fine loamy yellow sand				1	3	188	0
		Stiff grey clay and stones (? septaria)				20	0	208	0
		Black clay, with shells and stones, and phosphate nodules at 296ft. . .				91	6	299	6
? Coral Rag, 44¾ft.	{	Rock				12	9	313	3
		Stony clay and shells* (yellow gritty loam)				4	8	317	11
		Rock, with some layers of clay ..				9	11	327	10
		Stony clay, with layers of rock ..				8	10	336	8
		Rock (fragments of shell at 342ft.) ..				7	7	344	3
Lower Calc, Grit, 35¼ft.	{	Sand and stone				7	4	351	7
		Alternations of hard grey rock and clay				10	4	361	11
		Clay and Shells (dark gritty clay) ..				10	0	372	0
		Hard grey limestone (specimens) ..				2	6	374	6
		Sand and stone, with water				5	0	379	6
Oxford Clay.		Blue clay, soft and slightly mottled				4	6	384	0

With regard to the Gault, there is no record of any seams of phosphatic nodules or of anything other than clay. To estimate its thickness we must know the difference between the level of its surface at Shillingford and that of the base of the Malmstone on the south side of the river; the former is given on the six-inch Ordnance map as 156 feet, and the level of the latter may be taken at about 180ft., the difference being 24ft. ; adding this to the 144ft. of Gault in the boring, and the 19ft. of gravel which we must consider as replacing Gault, we get 187ft. for the total thickness of that formation below the arbitrary line which is taken as the base of the Malmstone.

* Well-sinkers often seem to use the word *shell* as if it were synonymous with shale ; and by *shelly clay* mean a shaly clay, not a clay with fragments of shell.

The presence and thickness of the Vectian (Lower Greensand) are important as showing that it may be expected to extend still farther eastward, and possibly to come within the limits of the London basin. In this connection it is a matter of regret that the Bushey boring was not carried through the Gault with the object of ascertaining the nature of the underlying strata at that spot. The Vectian sands yielded a copious supply of water at Shillingford, but on analysis it was found to contain a certain amount of free ammonia, and a large amount of sodium chloride.

The Kimeridge Clay appears to be 111ft. 6ins. thick, a depth which very nearly agrees with Professor Phillips's estimate of its thickness near Shotover. It had the usual character of a dark-coloured clay, with numerous remains of crushed shells, and contained a layer of phosphatic nodules near the base, among which casts of a *Trigonia* occurred.

At a depth of 299½ft. a hard rock was reached, but I did not succeed in obtaining a satisfactory specimen, a small piece shown me as coming from this horizon was a coarse, gritty sandstone, and Mr. Field in a letter to me says, "specimens from 314 to 318ft. included small pieces of hard, grey, gritty stone and hard, yellow loam which was soft at first but hardened on drying into a fine, gritty stone." We may conclude that this part of the section consisted of loamy clays and marls with layers of hard grit and sandstone. A specimen from 318ft. contained broken bits of grey limestone.

These beds were succeeded by argillaceous strata with layers of "rock," but all more or less hard, so that the punch was used continuously, and no good samples were obtainable. Fragments of oyster shells were abundant throughout.

I was at first inclined to class these beds down to a depth of 344ft. 4ins. with the Kimeridge Clay, as they did not appear to contain thick beds of limestone such as generally occur in the Corallian group; but, having regard to the great change which takes place in the composition of this group north-east of Oxford, I now think a somewhat similar change may take place to the south-east, and that these marly, gritty, and shelly beds may really represent the limestones of the Coral Rag.

Below this the record is sand and stone, and then alternations of hard grey rock with tough clays, which were described as similar to those between 318ft. and 335ft., the whole requiring to be punched. Next came 10ft. of softer material, a specimen of which from 370ft. was a dark, calcareous, gritty clay, probably a nearly black clay into which

quartz grains and calcareous matter had been carried down from above; for, on washing it, a residue of large grey quartz grains mixed with some fragments of shell was left. Underneath this was a compact, grey limestone, $2\frac{1}{2}$ ft. thick, and apparently the most definite bed of limestone found in the whole of the boring. Beneath it were sand and stone, with water which was not analysed, but is reported by Messrs. Isler to have been fresh and good, not salt. These beds may be referred to the lower calcareous grit, with a thickness of 35ft.

The clay below was soft and clean, and dried to a light grey. It was only penetrated to a depth of $4\frac{1}{2}$ ft.

The members of the Corallian group are known to change their characters within short distances, and, as they thin out altogether to the north-east of Oxford, it is not very surprising to find that the Corallian beds at Shillingford are very different from those which occur at the outcrop near Oxford. At Iffley and Headington they consist of an upper division of shelly limestones (25ft. thick), overlying soft sands, with layers and doggers of limestone, these lower sands being from 40ft. to 60ft. thick, and representing the lower calcareous grit of Wilts. At Shillingford the total thickness is much the same, but the limestone appears to have become shaly and argillaceous, while the underlying sands are largely replaced by layers of clay and rock. The change appears to be somewhat similar to that which is known to take place along the outcrop to the north-east, and it would thus seem that, in passing both to the N.E. and to the S.E. from Oxford, we travel away from the line of coral reefs around which the calcareous sandstones and shelly limestones of the typical Corallian area were accumulated.

THE SALINITY OF THE WATER.

The salinity of the water derived from the Vectian Sands is one of the most interesting results of the boring, though it was very disappointing to Mr. Field, inasmuch as the water was useless for brewing purposes. When the water first rose in the bore a sample was sent to Messrs. Gillman and Spencer, who made a partial analysis, and reported as follows:—

Hardness before boiling	..	..	..	..	8.96
Chlorine	..	..	..	..	119.60
Ammonia	..	..	..	..	.123
Do. albuminoid	..	..	..	..	.0021
Nitrogen as Nitrates	..	..	..	..	nil.
Nitrites	..	..	..	..	nil.
Amount of chloride of sodium	..	..	..	..	197.6 grains.*

* This is probably estimated in grains per 100,000 parts, and if so, it represents the quantity of 138.3 grains per gallon.

Continued pumping did somewhat diminish the saltiness of the water, but not to an extent that made it available. When tested again, six weeks after the above analysis was made, there were still nearly 55 grains of sodium chloride per gallon, and the complete analysis (made by Mr. J. Heron, F.C.S.) was as follows :—

“ Hardness before boiling	28·0
“ „ after „	16·0
Nitrogen as nitrates and nitrites	0·163
Oxygen required to oxide the organic matter ..	0·280

“ The mineral constituents are probably combined as follows :—

	Grs. per gallon.
Sulphate of lime	10·54
“ „ „ magnesia	3·02
Carbonate of lime	21·00
“ „ „ magnesia	none.
Sulphate of potash	4·17
“ „ „ soda	none.
Nitrate of potash	0·83
Chloride of soda	54·79
Silica	2·24
Organic matter	2·28
Oxide of iron	none.
	98·87”

The entire absence of oxide of iron in a water rising from sands which are almost always ferruginous is even more remarkable than the presence of the sodium chloride. The salinity of the water is, however, sufficiently surprising, for the same sands along their outcrop by Culham and Clifton Hampden yield a pure and drinkable water supply. It would appear that the water becomes impure as it passes beneath the Gault, for I find that other borings in this direction yielded similar salt and undrinkable waters. Thus, a boring near the railway station at Didcot was carried to a depth of 208ft. through the Gault into rock and sand, but the water then obtained was so impregnated with salt and iron as to be quite unfit for any use. Another boring was made at Wittenham, which lies between Didcot and Shillingford, in which salt water was obtained, though I cannot ascertain any particulars regarding it.

Several remarkable cases of saline waters arising from Jurassic rocks occur in the neighbourhood of Bedford, and the following is quoted from the Annual Report for 1888 to the Rural Sanitary Authority of the Bedford District by Dr.

C. E. Prior.* He mentions a band of saliferous rock, “ which appears to extend with the Oxford Clay formation from the northern border of the parish of Kempston across Wootton, and some way into Stanton. Analyses of waters from wells along this line gave the following results, the figures representing grains per gallon :—

	Total Solids.	Chlorine.	SO ⁴ .
Wootton Hall End (Keep's Well)..	229·6	.. 42·7	
Wootton Hall End (new well) ..	249·9	.. 41·4	
Wootton Church End (1877)..	199·5	.. 39·2	
Wootton House (1885)	188·4	.. 38·6	.. 57·19
Lower Shelton Marston.. ..	209·8	.. 72·1	.. 47·8

“ The enormous quantity of chlorine in these waters, existing probably in the form of common salt (chloride of sodium), is almost entirely derived from the stratum of salt-bearing rock, which extends, so far as I know, for many miles, and forms a serious drawback in any undertaking for the provision of water by other than shallow wells in this district. Chlorine in river waters and some others is often and justly regarded, according to its quantity, as an indicator of pollution ; the above however seems to show that in some districts its indications must be accepted with great reserve, and that it requires corroboration by excess of ammoniacal and organic matters found. One or two of the above waters were very pure in these respects.”

The saliferous rock in this case is probably the Kellaways, for the places mentioned are all on the lower part of the Oxford Clay.

The well at the Bedford County School also yielded salt water. Mr. A. G. Cameron informs me that this is seventy-five feet deep, passing through gravel, Cornbrash clay, and Cornbrash limestone, into Great Oolite, and finding water in a stone bed below a band of clay. The water was analysed by Dr. Prior, who found 218 grains of solid matter in the gallon, 86·5 being chlorine, and indicating a large amount of sodium chloride (about 187 grains). The water had a greenish tinge, and tasted salt.

Water containing a large quantity of sodium chloride (150 to 185 grains per gallon) was obtained from the boring at Bletchley, and this also appears to have risen from the sandstone of the Kellaway Rock.

* I am indebted to my colleague, Mr. A. G. Cameron, for calling my attention to this report.

Many other cases of deep-seated saline waters exist, and it is noticeable that they may proceed from clays and limestones as well as sands and sandstones, and several explanations of the salinity have been suggested. Two of these have been recently examined by Mr. H. B. Woodward in his paper on the Swindon boring.* In this boring salt water was met with at two horizons, the first supply rising from the Coral Rag, below seventy-two feet of Kimeridge Clay; and the second, from the Forest Marble, at a depth of 730 to 736 feet. The first contained eighty-six grains of sodium chloride and forty-nine grains of sodium carbonate per gallon; the second contained more than 2,000 grains of solid matter in the gallon, of which 1,824 grains were sodium chloride.

Mr. Woodward discusses the possibility of the salt water being derived from the salt-bearing Triassic rocks, but dismisses this theory as an unlikely one to account for the Swindon case. He points out the frequency of salt waters rising from Palæozoic rocks, and is inclined to believe that the Swindon waters rise from a ridge of such rocks at a considerable depth, so that the purer water percolating through the Jurassic strata is rendered locally saline by mixture with that rising from below. As to the means by which the uprise of the water is facilitated, he notices the possibility of its passing upward through fissures or lines of fault, but perceives the difficulty of supposing open fissures to traverse such thick and compact masses of argillaceous material as the Oxford Clay. He prefers to assume the existence of a ridge of Palæozoic rocks, and to suppose that the Secondary strata are banked against this ridge in such a manner that water may find its way directly from the former to the latter at more than one horizon.

Apart, however, from the assumptions which he admits to be involved in this hypothesis, there is the fact that the quality of the saline waters varies greatly within short distances, and that in several cases near Swindon good fresh water has been found by boring through the Kimeridge Clay into the Coral Rag; whereas, if the saline water finds its way horizontally from a subterranean ridge along the permeable strata, one would certainly expect all the water derived from one stratum in the district to be more or less saline. It is still more difficult to apply the hypothesis to all the cases of saline waters that are known in the counties of Wilts, Berks, and Oxon; neither can we suppose that in every case such

* Quart. Journ. Geol. Soc., vol. lxii., p. 289.

waters rise from below along lines of fault or fissure ; while in the Shillingford case the difficulty is further increased by the fact that the water supply from the lower horizon, instead of being salter than that in the higher beds (as at Swindon), is reported to be fresh and drinkable.

It is indeed unlikely that all the deep-seated saline waters in these counties have derived their salinity from the same source, and each case must be considered separately. I cannot but think, however, that, in many cases, the saline solutions are not now being introduced from any extraneous source, but are either derived directly from the materials of the rocks in which they occur or from salts left by the former passage of sea-water through these rocks, and preserved in certain localities under special stratigraphical conditions. I am disposed to think that in the case of the Shillingford and Didcot borings the salinity of the water found in the Vectian sands may be due to the peculiar stratigraphical position of these sands. They rest unconformably on the Kimeridge Clay, and they are often overlapped by the Gault. The general dip of all these strata is to the east-south-east, and their out-crops sink to lower and lower levels as they are followed across the country toward the valley of the Thames, both from west to east in Berkshire, and from north-west to south-east in Oxfordshire. In consequence of this inclination the natural direction of flow for water percolating through the sands beneath the Gault would be eastward toward the London basin.

Judging however, from the irregular and discontinuous occurrence of these sands along their line of outcrop in Oxfordshire and Berkshire, it seems probable that their easterly continuation may be equally discontinuous, so that it is quite possible that at a distance of a few miles east of Shillingford they may be overlapped and completely cut out by the Gault ; this clay coming into apposition with the Kimeridge Clay for a certain space as it does near Culham. If this were so, and even if the Vectian sands were perfectly continuous to the southward or northward, but rising to higher levels, the water in the sands below the Thames Valley would be backed up, and though there might be egress to the southward at some higher level, yet there could be no rapid outflow. The water in the lower part of the basin would be, to all intents and purposes, stagnant, and the outward diffusion being slow, it would become saturated with salts and mineral matters dissolved from the ferruginous sands in which it lay.

THE FUNGI OF WARWICKSHIRE.

BY W. B. GROVE, M.A., AND J. E. BAGNALL, A.L.S.

(Continued from page 192.)

624. *C. vermicularis*, Scop. Warwick, September, 1872, *Perceval*. Kenilworth, *Russell*, *List*. Kingswood, October, *Hawkes*! Ansty, *Adams*.
625. *C. fragilis*, *Holmsk*. *C. cylindrica*, *Purt*. On Alne Hill, *Purt*. ii. 699. Hopsford, *Adams*. Coleshill Heath; New Park, Middleton (var. *flava*, *Bull.*); Kingswood.
626. *C. pistillaris*, *Linn*. *C. Herculanea*, *Purt*. Woods. October-November. In shady woods. Very rare. Wetheley Wood, *Purt*. iii. 270.

Genus XXXIV. CALOCERA. *Fr.*

627. *C. viscosa*, *Fr.* On fir stumps. August to October. Coleshill Pool; Sutton Park.
628. *C. cornea*, *Fr.* On squared rotting timber. July to October. Hopsford, *Adams*. Driffold Lane, Sutton; Edgbaston Park; Rotton Park Reservoir; Trickley Coppice; Coleshill Pool.

Genus XXXV. TYPHULA. *Pers.*

629. *T. gyrans*, *Fr.* *Clavaria*, *Purt*. October. In the lane leading from Oversley to the Mill, *Purt*. ii. 695.
630. *T. phacorrhiza*, *Fr.* *Clavaria*, *Purt*. Allesley, *Bree in* *Purt*. iii. 268. [*T. Grevillei* occurs in Worcestershire, near Harborne, and not far from Warwickshire.]

Genus XXXVI. PISTILLARIA. *Fr.*

631. *P. micans*, *Fr.* On dead thistles. June. Solihull; somewhat doubtful.
632. *P. quisquiliaris*, *Fr.* On fern stems. October. Trickley Coppice; Lady Wood, Four Oaks.
633. *P. rosella*, *Fr.* On nettle stems, September, 1883, Driffold Lane, Sutton (the first British locality); on rotting stems of *Heracleum*, August, 1884, Bradnock's Marsh.

ORD. VI.—TREMELLINEI.

Genus XXXVII. TREMELLA. *Dill. Fr.*

634. *T. foliacea*, *Pers.* On stumps. Sutton Park, September, 1881; December, 1882.

635. *T. mesenterica*, *Retz.* On sticks in woods, Warwick, *Perceval.* Hopsford, *Adams.* Driffold Lane, Sutton; Crackley Wood, Kenilworth.
636. *T. albida*, *Huds.* On dead branches. October-November. Warwick, *Perceval.* Upper Nut Hurst, Sutton Park; Wylde Green.
637. *T. moriformis*, *Eng. Bot.* On sticks. Rare, At Gorcot Hall, on pea sticks, *Purt.* ii. 616.
638. *T. tubercularia*, *Berk.* On fallen branches. October. Driffold Lane, Sutton; Olton.
639. *T. torta*, *Berk.* On dead oak. August to October. Crackley Wood; Spernall.

Genus XXXVIII. EXIDIA. *Fr.*

640. *E. recisa*, *Fr.* *Tremella boletiformis*, *Purt.* Rare. December. On the decayed branches of a willow close to the water at Oversley, and also near to Great Alne Mill, *Purt.* ii. 615.
641. *E. glandulosa*, *Fr.* *Witches' Butter.* On dead oak branches. October. Combe, *Adams.* New Park, Middleton; on fallen trees near Solihull; Kenilworth.

Genus XXXIX. HIRNEOLA. *Fr.*

642. *H. Auricula-Judæ* *Berk.* *Jew's Ear.* On elder. October to June. Warwick, *Perceval.* Hopsford, *Adams.* Driffold Lane, Sutton; Packington Park.

Genus XL. DACRYMYCES. *Nees.*

643. *D. deliquescens*, *Dub.* On fallen branches. Driffold Lane, Sutton; Coleshill Heath.
644. *D. stillatus*, *Nees.* On rotting wood. Common. Warwick, *Perceval.* Birmingham; Sutton; Coleshill; Bradnock's Marsh, &c.

Genus XLI. DITIOLA. *Fr.*

645. *D. radicata*, *Fr.* Very rare. On deal planks, Driffold Lane, Sutton, February, 1883. Exactly like fig. 101 of Cooke's Handbook.

F A M. II.—G A S T R O M Y C E T E S .

ORD. VII.—PHALLOIDEI.

PHALLUS. *Linn.*

646. *P. impudicus*, *Linn.* *P. fatidus*, Sow, *Purt.* *Stinkhorn.* Woods. Local. July to October. Ragley Woods,

Purt. iii. 470. Hopsford; Combe, *Adams*. Sutton Park; Trickle Coppice and New Park, Middleton; Coleshill Pool; Witton; Ward End Hall; Edgbaston Park; Hams Hall.

(*To be continued.*)

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—BIOLOGICAL SECTION.—August 11th. Mr. R. W. Chase in the chair. Mr. W. P. Marshall exhibited a specimen of dodder (*Cuscuta Epithymum*) parasitic on gorse, from Guernsey, and two beautiful specimens of tubulariæ from Sark. Mr. Steele Elliott exhibited five eggs of the Arctic tern (*Sterna arctica*), showing variation of colour, and a clutch of eggs of missel thrush (*Turdus viscivorus*), abnormal both in size and colour. Mr. C. J. Watson exhibited under the microscope a transverse section of butchers' broom (*Ruscus aculeatus*), stained with aniline. Mr. Bolton exhibited a fresh-water sponge, and under the microscope, nostoc? (*Cristatella unicedo* and *Conochilus volvox*).

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—June 22nd. Mr. H. Hawkes showed specimens of the butterfly orchis, *Habenaria bifolia*, and other plants, from Kingswood; Mr. Corbett, polished slabs of Anglesea marble (an altered mountain limestone) from the Town Hall. Under the microscopes, Mr. Hawkes, section of stem of *Villarsia*, with stellate cells; Mr. J. Collins, *Spirogyra crassa* in conjugation; Mr. Camm, *Lamproderma nigrescens*, an elegant fungus found on dead leaves. A paper was then read on "A Trip to North Devon," by Mr. Wiltshire. The writer spoke of the different routes of reaching that picturesque county, but gave preference to the one *via* Bristol and Portishead, down the Channel, by Weston-super-Mud, as it has been most unjustly called, on to Ilfracombe. The leading features of the town were described, and the following places visited: Morthoe, Barracomb, Wallacomb Sands, Hillsborough (one of the few places on the coast where the sun can be seen to rise and set in the water), Watermouth, Combe Martin, Clovelly, Lundy Island, and Lynmouth. The natural beauty and points of scientific interest of each locality were described at some length, and illustrated by a large series of photographs and some ferns and other plants.—June 29th. SPECIAL.—CONCHOLOGY. Mr. S. White showed a collection of shells of *Helix aspersa* and *H. nemoralis*, from various localities; Mr. J. Madison, a case of our smaller bivalve shells; Mr. G. H. Corbett, a specimen of *Nummulites nummularia*, from the Great Pyramid, Egypt.—July 6th. Mr. Round showed various specimens of rock salt from the Cheshire mines, also of the stone on which it beds; Mr. Lilly, marine shells and corals from Studland, Dorset; Mr. J. Linton, marine shells and specimens of *Helices* from Ceylon; Mr. H. Hawkes, flower head of

goat's-beard infested with smut, *Ustilago receptaculorum*, remarking that though this fungus was very common for years in one place, yet it had gradually diminished until only one infected plant was now found, probably from the fungus destroying the host plant. Under the microscope, Mr. J. W. Neville exhibited a gathering of foraminifera from Borth; Mr. J. Moore, gizzard of beetle, *Carabus arvensis*; Mr. J. Collins, specimens of nostoc.—July 13th. PRACTICAL MICROSCOPY. Mr. J. W. Neville gave a demonstration of the use of carbolic acid in microscopic mounting. This is a medium through which objects can be passed directly from water into Canada balsam. Its use was particularly advantageous for objects that shrunk and cracked in drying, and also for those that were difficult to rid of air, and it was perhaps the most simple of the "wet methods." A number of objects were then mounted to show the process, a minute or two sufficing to transfer them from water into balsam. Mr. J. Collins also gave a demonstration on mounting algæ, etc., in fluid. These objects required some preparation to fix the cell contents; this was done by soaking them for some hours in a dilute solution of picric acid, and then transferring them to dilute glycerine. A number of cells should be made with gold size on the slips, and when quite dry, the mounting can be proceeded with. This process was shown, great importance being attached to the proper quantity of fluid put into the cell; if too much was used, it would be found troublesome to clean the slide before sealing it with gold size. At the close of the demonstrations a number of slides were handed round for inspection, and that gave rise to a discussion on the processes employed.

BIRMINGHAM ENTOMOLOGICAL SOCIETY.—July 20th. Mr. R. C. Bradley in the chair. Mr. G. H. Verrall, F.E.S., was present, and delivered a lecture on "Diptera." He said he had come down with the hope of inducing some of the members to take up the study of the group, which offered many recommendations not possessed by other orders of insects. They were very little worked, and any student would find original work to do, and be able to add new species to the British list, he himself having added a very large number; also much work can be done without going far, even one's garden affording much material. In his own garden, at Newmarket, he has taken 500 species. He briefly described the classification, characters, etc., of the order, and ran in review the families, giving their salient points and many interesting facts about them. At the close, Mr. C. J. Wainwright proposed a vote of thanks, which was seconded by Mr. G. H. Kenrick, supported by Dr. P. B. Mason, and replied to by Mr. Verrall.

CARADOC FIELD CLUB.—The long meeting of the Caradoc Field Club was held this year at Bakewell, in the Peak District of Derbyshire, and, though but thinly attended, proved to be one of exceptional interest to all, each student of any special science finding pleasure and instruction from the observations of those who followed other lines of thought. The party assembled at the Rutland Arms Hotel, at Bakewell, on the evening of the 28th July, and took the opportunity afforded by the two hours before dinner to thoroughly explore the church and to visit the chest quarry in the limestone close to the town. The church, though consisting of a fabric erected almost entirely in 1841, contained many valuable lessons in the ways and

manners of past times. Outside, and still standing in the place of its original erection, is a stone cross of supposed Saxon date, ornamented with rough sculptures representing scenes from the life of Christ, and in the interspaces with scroll-work of a semi-Italian character, which would seem to imply that our Saxon forefathers were indebted to the South of Europe for their ideas of ornamentation. In the porch is a unique collection of stone coffin lids, which had been preserved for future generations by being built into the walls of the new edifice in 1260, whence they were only brought to light in the re-building of 1841. These are also supposed to be of Saxon date, and the patterns carved on them in some instances bear a close resemblance to the above-mentioned scroll-work. The method of working out the patterns on the surface of the stone was well shown, for in many places the original drill-holes that had been made along the lines drawn were plainly discernible, the parts between having been picked out afterwards to a rather less depth. In the interior of the church there is an octagonal font (Norman), and at the west end a small portion of the original Norman wall is still to be seen. Its square angles and simple round-headed arches, destitute of architectural ornament, were generally considered to indicate eleventh century work. Several interesting monuments were seen in the Vernon Chapel, dating from the 14th, 15th, and 16th centuries; and the ornamentation of the chancel carried out in recent years was much admired. On reaching the quarry the geological section began to collect fossils from the carboniferous limestone, a pursuit which was carried on almost without intermission throughout the excursions, and the botanists were already on the lookout for specimens of the limestone flora. The next morning the party were off in good time for a drive of 16 miles to Castleton, taking the route by Tideswell. The church here is of special interest, as exhibiting a transition between the decorated and perpendicular styles of architecture, and also as containing some beautiful carved screen work by a local and living artist, whose acquaintance some members of the party were fortunate enough to make. The whole route lay through a very interesting country, the monotony of the bleak uplands forming a grand contrast to the beautiful variety of rock and foliage in the dales, while every wall was in itself a museum of fossils. The excavating power of running water was well exemplified in every rocky hollow, the sides of which showed layer upon layer of massive limestone, which at one period of the earth's history must have existed as calcareous mud at the bottom of the ocean, the waters of which were teeming with molluscan and crinoid life. In Tideswell dale examples of "Toadstone" were noted, showing that during the formation of the limestone there were intervals of volcanic action when huge sheets of basaltic lava were creeping along over the ocean bed. In Bradwell dale a section was seen showing that other interludes occurred in the formation of the deposit, for the lower strata appeared to have been lifted near enough to the surface to be within the influence of waves and currents, and had been cut off to a fresh level surface, upon which were laid down in a horizontal position the succeeding layers of limestone. At Castleton, about three hours were available for exploration, and good use was made of the time. Mam Tor, or the "Shivering Mountain," was ascended, and notes were made of the ancient camp crowning its summit, as well as of the strata (Yoredale Shales) which are well seen in the faces of a landslip to form the mass of the hill. Here the sandy nature of the deposit and the frequent occurrence of fragments of land plants, speak of a gradual shallowing of the ocean bed with its mantle of calcareous mud, and of the comparative

proximity of a land surface, where forests of vegetation flourished which were the precursors of those which later in time spread over a wider area and furnished the material for our present stores of coal. The rocky gorge of The Winniats (Wind-gates) was also traversed, and subsequently the Peak cavern was visited, and its recesses explored. Unlike most limestone caverns, this one is almost destitute of calcareous incrustations, and presents instead many beautiful examples of natural arching and groining. In times of heavy rain the water from the high land above finds its way by devious underground channels to the Peak cavern, and so swells the volume of the little stream as almost to fill the passages. The absence of stalactites is probably in a great measure due to this, for as soon as they begin to form on the roof the flood waters would come down and sweep them away. A totally different route was taken for the return journey to Bakewell, affording fine views of Hathersage and the Derwent Valley, high up on the east side of which was seen the escarpment of the Millstone Grit, with its characteristic perpendicular cliffs at the top, followed by a long slope, consisting of the underlying Yoredale Shales. Thursday was devoted to Dovedale, which was reached after a long drive over the central high land of the district. *En route* a halt was made to allow of a visit to the "Druidical Circle" of Arbor Low. This ancient monument consists of a circle of about thirty prostrate stones surrounded by a ditch and mound, with a small subsidiary enclosure adjoining on one side. At first sight the earthwork suggests fortification, but the two wide entrances to the north and south and the position of the ditch inside the mound seem rather to imply that it was only formed to mark the precincts, with possibly the subsidiary use of affording a vantage ground for the populace when any ceremonies were being enacted. Dovedale was reached about two o'clock, and the whole party enjoyed a two hours' ramble among the rocks and woods. The plants collected from this valley were of unusual interest. The geologists also had good reason to be satisfied with the day's work, for among other specimens was one of the genus *Phillipsia*; not that this is by any means a rare form to meet with in the limestone, but that it is one of the last relics of the large family of trilobites so plentiful in the older rocks of Shropshire, which form of life was destined to disappear altogether from the earth with the close of the Carboniferous period. On Friday morning those members of the party who could wait till the evening train enjoyed a visit to Haddon and Chatsworth, which are too well known to need even a cursory description.

SEVERN VALLEY FIELD CLUB.—LILLESHELL MEETING.—The last meeting of the season took place on July 24th. Members arrived at Donnington at 10-45, and proceeded to Lilleshall. On arriving at the village the party examined the green sandstones, which recent researches have shown to be of Lower Cambrian age. They then studied the remarkable series of volcanic lavas and ashes constituting the mass of the hill. These rocks, formerly supposed to be the Silurian strata altered by an intrusion of "basalt," form part of the great Uriconian (from the Wrekin) system, recently admitted by Sir Archibald Geikie to be the type of the oldest volcanic formation in Britain, being of pre-Cambrian age. The party then wended their way to the summit of the hill, and near the famous Lilleshall monument an address on the geology of the district was given by Dr. Callaway, who said: On the map of the Geological Survey, this ridge

is represented as a mass of altered Caradoc sandstone, with a lump of "greenstone" intruded somewhere near the middle, the metamorphism of the sandstone being presumably attributed to the presence of the igneous rock. On the east of the hill, in the main street of the village, there crops out a greenish sandstone, which the survey regarded as the unaltered Caradoc. This reading of the local geology has the merit of simplicity, but it is demonstrably erroneous in every particular. The intrusive greenstone and the altered sandstone do not exist, and the unaltered sandstone in the village is not of Caradoc age. Recent researches have shown that the supposed Caradoc sandstone is of Cambrian age, while the hill itself chiefly consists of volcanic ashes and flows of lava which were once ejected at the surface in the manner of modern eruptions, and these interesting rocks, so far from being younger than the Caradoc epoch, are really older than the Cambrian. I have, therefore, the pleasure of introducing to the club the oldest volcanic formation that has yet been detected in the earth's crust, a formation which dates back to an epoch anterior to the deposit of the ancient strata in which the oldest known fossils have been discovered. The famous *Eozoon canadense*, the so-called Dawn-Animal of Sir Wm. Dawson, is indeed of greater antiquity than this great volcanic system; but, as I regard Eozoon as one of the Mrs. Harrises of geological science, I do not take it into account. It was necessary to prove (1) that the green sandstone in the village was of Cambrian age, and (2) that the volcanic rocks are of greater antiquity. These points are more clearly shown in the Wrekin and at Caer Caradoc. In those localities the sandstone contains Lower Cambrian fossils and is underlain by a band of quartz-rock, which rests transgressively upon the upturned edges of the lavas and ashes, and furthermore contains in abundance well-rounded pebbles of the lava. The discordance between the two formations is also well seen at Lilleshall, the green sandstone dipping to the south-east, while the volcanic strata have a dip to north or a little west of north. The volcanic rocks are therefore older than the Cambrian sandstone, and older by an interval. I am disposed to regard that interval as a rather wide one. These lavas and ashes are most fully displayed at the Wrekin and in the hills to the east of Church Stretton. They are of enormous thickness; but as no base or summit to the series is known, no estimate can be offered. As the typical sections occur in the Wrekin, I have proposed for this great volcanic system the name of Uriconian. These results have been long admitted by students of the old rocks. The most recent convert to the new views is Sir Archibald Geikie, Director-General of the Geological Survey, who, in his presidential address to the Geological Society in February last, gives an outline of the evidence, and adopts the term "Uriconian" for the new system.—Mr. Edward Jones, of Granville Lodge, St. George's, made some interesting remarks on the formation of the Coalbrookdale Coalfield, in the course of which he said: 'Twenty-five years ago I read a paper touching upon the working of the limeworks, &c., in that district. I may here observe that the original Government Geological Survey of the district is not very accurate, and the faults marked wide of the lines as they practically exist. The champion fault running through the heads of the coalfield is called the Lightmoor fault. It takes its rise at Lincoln Hill, near Coalbrookdale, runs through Lightmoor, under Malinslee and Priorslee Churches, and 200 yards east of St. George's Church, 150 yards east of Muxton Bridge, and was supposed and delineated to run 500 yards east of Lilleshall Church; but subsequent workings have proved that the fault was through the hill, and

on to Chetwynd Park, hence the fact of that great upheaval. This is a large fault showing a dislocation of at least 300 feet "dip" side or downthrow east. The great east fault runs parallel to this. On the western slope of the red hill the Permians are brought into juxtaposition with the coal measures; it there forms an anticlinal, and is of considerable size. It runs from this point in a bee line to and under Aston and Newport Churches. Trial sinkings were made on the dip or east side of the dislocation at the Crow Hays, near Willmore Pool, and the lower series of the coal measures were found at a depth of 140 and 157 yards respectively. The middle and upper series were wanting. This sinking was continued to a depth of 240 yards, and struck the root of the hill, viz., the igneous rocks. The trial borings now being made by Mr. Tayleur, N. E. of Newport, may be successful in winning coal at a depth (say 400 yards) below the Bunter Sandstone; if so, it will be a great blessing to the country. Drawing a bee line from Lilleshall Hill to the Wrekin, I feel sure no coal will be found west of that line. Trial bores have been made at Hadley Park at four places, and the igneous rocks touched in each bore. I had a bore put down on the Preston Hospital Estate in 1888, to a depth of 146 yards, and from first to last it was in the soft, loamy, upper new red sandstone. Situation just opposite the Old Shaw Birch Inn, Trench Lane, a few feet from the road. Bore dry. The influx of water that inundated the Aston Limeworks was not in the limestone itself, but broke in at the east slip fault, at a point where the limestone bed was found to be in juxtaposition with the Permian rocks, out of which the water poured in and quickly rose to the surface, and flooding those valuable works over an area of 200 acres in a few days.—A vote of thanks was then proposed to the president (Dr. Callaway) for his very learned and able address, on the proposition of the Rev. R. C. Wanstall, Condover, seconded by Mr. C. J. Southwell, Bridgnorth. Dr. Callaway, in response, thanked Mr. Jones for his remarks on the subject. The church was then visited, which contains some excellent specimens of Norman architecture, including a very ancient font, sculptured with Norman arcades. The vicar of Lilleshall (Rev. W. J. Price) was unavoidably absent, but his sister, Miss Price, rendered valuable assistance to the club. A move was then made to the ruins of the Abbey, where luncheon was taken in picnic fashion. By the kindness of Mr. C. C. Walker, a large plan of the ruins had been prepared, which proved of great service to the members of the club. The President proposed a vote of thanks to Mr. Walker for his kindly assistance, and regretted his absence through a domestic affliction, but congratulated the members on having the assistance of Mrs. Walker. This was seconded by the Hon. Sec., and carried. The majority of members then partook of an excellent tea, provided by Mr. Dyer, at the Victoria Coffee Rooms, Donnington, and left that station by the 4.45 train for Wellington, Bridgnorth, and Shrewsbury. The following were present on the occasion:—Dr. Callaway (president), Mr. C. J. Southwell (vice-president, Bridgnorth), Mr. Bodenham (vice-president, Edgmond), the Rev. R. C. Wanstall (hon. sec. and treasurer, Condover), Canon and Miss Nash (Little Wenlock), Rev. T. and Mrs. Owen (Wellington), Mr. E. and Miss Hodges (Edgmond), Mr. E. Jones (St. George's), Miss Gordon and Miss Windle (Oldbury, Bridgnorth), Rev. R. and Mrs. Woods (Malinslee), Mrs. Walker and Miss Price (Lilleshall), Mr. and Mrs. Ray (The Leasowes), Miss Bellis and Miss Slaney (Wellington), Miss Darby (Coalbrookdale), Miss Ethel Richardson (Edgbaston), Mrs. Bodenham (Edgmond), Miss Daisy Bellis (Dudley), &c.



Fig 1.

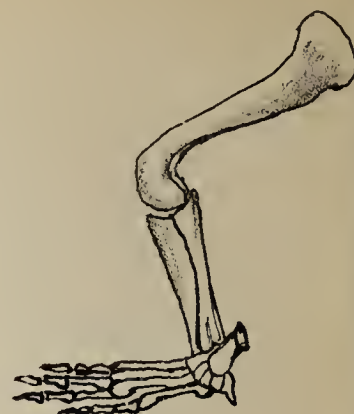


Fig 2.



Fig 3.

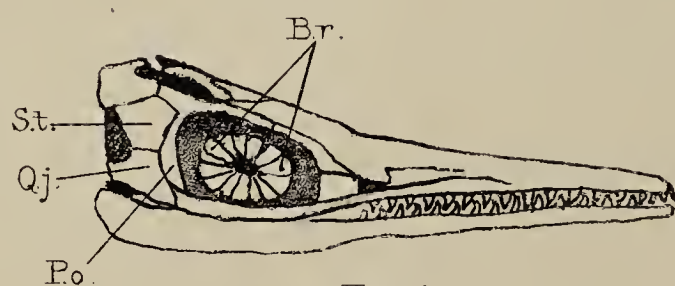


Fig 4.

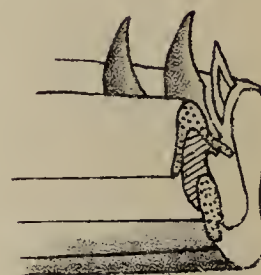


Fig 5.

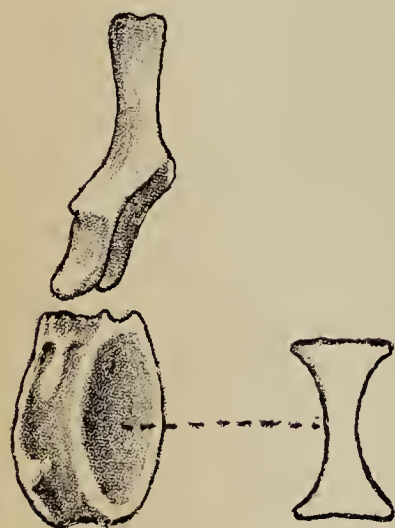


Fig 6.



Fig 7.



Fig 8.



Fig 9.



Fig 10.



Fig 11.

“DRAGONS OF THE PRIME.”*

BY A. BERNARD BADGER, B.A.

There is nowadays no ordinarily well-informed person who is not aware that formerly there lived on this earth animals which, in the size of their bodies and limbs, and in the ferocity of their natures, were the equals of the most horrible dragons and griffins which the imagination of man has conceived; in fact, the existence of creatures, some of which were half crocodile, half fish, others half crocodile, half bird, has become one of the common-places of knowledge, while the names of the *Ichthyosaurus*, *Plesiosaurus*, and *Deinosaur* have become almost household words. It is of these

“Dragons of the prime,
That tear each other in their slime,”

as Tennyson says, of the *Ichthyosaur*, *Plesiosaur*, and *Deinosaur*, that I now wish to speak; you may think, therefore, that it is somewhat of a hackneyed subject which you are invited to consider. It has seemed to me, however, that while everyone who has studied geology, even a little, has heard something of these animals, yet but few have studied them in detail and know the real interest of their structure. It is my object to show that these animals are interesting, not so much because they are enormous in size and strange in appearance, and very unlike any of the creatures which we are accustomed to see about us, but rather on account of the relation of their structure either to that of other animals or to their mode of life. These, then, are the two points of view from which we will regard them:—

DESCRIPTION OF FIGURES IN PLATE 12.

Fig. 1.—*Ichthyosaurus* restored.

Fig. 2.—Hind-limb of Crocodile.

Fig. 3.—Paddle of *Ichthyosaurus*, shewing rounded flattened character of the bones, which are enclosed in an envelope of skin.

Fig. 4.—Skull of *Ichthyosaurus*: *St.*, supra-temporal, *Qj.*, quadrato-jugal, *Po.*, post-orbital bones roofing in the infra-temporal fossa. *Br.* bony ring of eye.

Fig. 5.—Part of lower jaw of *Ichthyosaurus*.

Fig. 6.—A vertebra of *Ichthyosaurus*, shewing the biconcave vertebra.

Fig. 7.—*Plesiosaurus* restored.

Fig. 8.—Paddle of *Plesiosaurus*, shewing its elongated flattened bones.

Figs. 9, 10, 11.—Diagrams to illustrate the evolution of *Plesiosaurus* (Fig. 11) from an ancestor like *Dactylosaurus* (Fig. 9), through a form like *Neusticosaurus* (Fig. 10).

* The substance of a lecture delivered at the late Summer Meeting in Oxford of the University Extension Students.

(1) The relation of their structure to their mode of life and surroundings, that is, their adaptation to environment.

(2) The relation of their structure to that of other animals, *i.e.*, their position in the pedigree of animals. In this connection some of these old reptiles are of great interest and importance, as affording good proof of the evolution of one series of animals from another, for they form links in the chain of life, and connect together animals which are now very different in structure.

Let us first consider the *Ichthyosaurus*. This animal lived in the seas of the Mesozoic Age, and, as its name indicates, is in structure partly like a reptile, partly like a fish; or, in other words, it combines characters some of which are distinctive of the class of fishes, some of the class of reptiles. It is, on the whole, distinctly a reptile, but a lowly organised one.

In shape *Ichthyosaurus* was "very like a whale," or rather a porpoise, for the body was somewhat blunt in front, and tapered behind into a long powerful tail, which carried a vertical fin. (Fig. 1.) Being of such a shape, the animal was admirably adapted for movement in the water. Its skin was, perhaps, smooth, and without scales; if scales were present they were not so thick and strong as those with which living reptiles are covered, the animal depending for defence from enemies on its own powers of offence.

Attached to the trunk, were four limbs, one pair in front, one behind: they had the form of paddles. The *Ichthyosaurs* varied in size. Some were small, others large—the largest individuals known are 30ft. long. The head was very large in proportion to the body, being a quarter of the whole length. It was united to the trunk by a very short neck only. The jaws were very long, and were armed with great sharp teeth like those of crocodiles. With these jaws the fierce *Ichthyosaurus* seized its prey, and depended for its existence on the quickness with which it could move up and down in the water, and from side to side in pursuit of the animals which formed its food. Since the neck was so short, the head could not be moved to any great extent from side to side without corresponding movements of the whole body. How, then, were they effected? By means of the vertical tail-fin, by the motion of which *Ichthyosaurus* was able to dart from side to side with great ease and swiftness, just as the porpoise and grampus do. The motion of the body in other directions was produced by the movement of the paddles. These organs were quite different from the fins of fishes, and somewhat resembled the flappers of whales and porpoises. Each paddle or flapper (Fig. 3) was made up of bones which

correspond to those of the limbs of a frog, of a crocodile (Fig. 2), or of a man, but are simpler in shape : thus, in the fore-paddle, there is an upper bone which corresponds to that in the upper part of the arm, namely, the humerus ; on it follow two shorter bones corresponding to those in the fore-arm ; then come a number of bones which answer to those of the wrist, the palm, and the fingers. In some cases there were as many as six, seven, eight, or even nine rows of finger bones. The paddle of Ichthyosaurus, then, in its composition was like the fore-limb of a crocodile, but different in this that the fingers were not enclosed in separate stalls of skin as our fingers are, but were all enclosed in the same sheet of skin, so that the paddle was like a hand in a mitten, without any thumb, not like a hand in a glove.

Of the two pairs of paddles, the front ones are the larger, and were used for driving the animal both upwards and downwards in the water ; the hinder paddles were used, perhaps, for driving *upwards* only. This seems probable, because in the whales and porpoises there are no hind-limbs, but the tail has a broad, horizontal fin by means of which the animals are driven upwards. Hind limbs, therefore, are not required for this purpose. As in the whales, so also in Ichthyosaurus, it was very necessary that an upward movement could easily and quickly be made, since the creature, like all reptiles, possessed lungs, and required to ascend to the surface of the water to breathe air.

In relation to the importance of the limbs in driving the animal up to the surface, is the strength and extent of the shoulder-girdle. Its strength of structure prevented the lungs from being compressed by the great weight of water when the animal was deep below the surface, while the broad bones of which it is composed presented a fit surface for the attachment of the powerful muscles by which the paddles were moved.

If now we look at the jaws (Fig. 4), we find that they carry numerous pointed teeth, which have sharp cutting edges. Ichthyosaurus, no doubt, was a very ferocious and greedy fellow, and preyed on the numerous fishes and cuttles that swam about in the Mesozoic waters, seizing them with his jaws. Now, in order that he might seize his food easily and with certainty, his jaws are long and slender, and very light, so that they could easily be snapped together. But it is plain, that the strain on the lower jaw when a large powerful animal was seized and retained would be very great, and would certainly have broken it had it been made of a single bone. In relation, however, to the strains and shocks which it had to

endure, the lower jaw (Fig. 5) is made, not of a single bone, but of six separate pieces on each side, which are braced and united together so as to form a structure which is at once light and strong, and gives the greatest elasticity with the least weight. The same principle is involved as when several separate pieces of steel are united to form a spring for a carriage.

Another feature of the head of interest in regard to the mode of life of Ichthyosaurus was the enormous size of the eyes. (Fig. 4.) In the largest specimens they were as much as a foot across, and each was protected by a ring of bony pieces (*Br.*). Now very large eyes are found in those fishes which live at such great depths in the sea that it is almost quite dark, the rays of sunlight which penetrate there being so few and feeble. Hence, we may perhaps conclude that Ichthyosaurus also went down into the abysses of the ocean, where he needed his enormous eyes to catch the few and dim rays of light which penetrated so far.

As to the bony ring, that had two uses ; in the first place, it served to protect the eye from the pressure of the water at great depths, and from the force of the waves at the surface ; in the second, it was the point of attachment of the great muscles, which altered the shape of the lens in accordance with the need for long distance or short distance vision. Thus, by means of the ring, the eye could be converted into a microscope for near vision, and into a telescope for distant vision, and was, therefore, an optical instrument of varied and great power, enabling the Ichthyosaurus to descry its prey at great or little distances in the obscurity of night and of the depths of the sea.

But the Ichthyosaurus had not only the two ordinary eyes, one on each side of the head, he also had an eye on the top of his head in the middle. To prove this statement now, would take me too far away from my present subject. I will only say that in the top of the skull of Ichthyosaurus is a great hole, through which light entered into the third eye that was seated near to the surface of the brain.

So much for the adaptations of structure to the mode of life : now, with regard to those features which are of interest as throwing light on the pedigree of Ichthyosaurus and its relations to other animals. Undeniably, Ichthyosaurus is a reptile. The structure of its skull and teeth, as well as other features of its skeleton, establish this beyond a doubt. Yet, though a reptile, it is not closely related to any other known, either living or extinct, while in some features of its structure it resembles fishes and amphibia.

(1.) In the first place, its *vertebræ* are not like those of most

reptiles. The body of each vertebra (Fig. 6) is hollowed out at either end, in other words, it is biconcave. Now, such vertebræ are but rarely found in existing reptiles, but are very commonly present in fishes and some amphibia—those huge forms, for instance, the Labyrinthodonts, which crawled about the marshy lands where our coal was formed. These biconcave vertebræ, then, show that Ichthyosaurus was connected with lower forms of animal life than reptiles.

(2.) Again, in the skull (Fig. 4), the bones form a very complete roof, more so than in any existing reptiles, for the infra-temporal fossa is covered over by bones—post-orbital (*Po.*), supra-temporal (*St.*), and the quadrato-jugal (*Qj.*). This arrangement is not found in existing reptiles, but in extinct amphibia—the Labyrinthodonts just mentioned.

(3.) The bones which make up the paddles (Fig. 3) are very simple in character, and are much less specialised than those of the limbs of most other reptiles (Fig. 2) and of amphibia. On the other hand, the bones of the fins in fishes which correspond to those of limbs of Ichthyosaurus are even less specialised than in the latter. It has been supposed, therefore, that the paddle of Ichthyosaurus is a stage between the fin of the fish and the fully developed limb of the amphibian reptile. But there is some evidence to show that the paddle of Ichthyosaurus is not so primitive a feature as would at first sight appear, for it is said that the Triassic Ichthyosaurs had the humerus, ulna, and radius longer than in the Liassic species. If this be so, it shows that the Ichthyosaurian paddle is a secondary structure.

While, then, Ichthyosaurus is undoubtedly a reptile, yet it shows connections with the lower groups of the fishes and amphibia. Nowadays we believe that the reptiles are the descendants of certain amphibia, and the amphibia to be the descendants of certain fishes. Hence, at first sight, we might imagine that in Ichthyosaurus we had the transitional form, the missing link between fishes and reptiles; and, since in structure he is partly fish, partly amphibian, partly reptile, we might think he was the descendant of the former and ancestor of the latter. But this is probably not so. Ichthyosaurus is, indeed, the descendant of a fish-like ancestor, yet he is not the parent of other reptiles; he is only nearer than other reptiles to that animal which is the common ancestor of them all.

Now, let us examine into the structure of *Plesiosaurus* (Fig. 7), a creature which derives its name from the fact that it is more like a lizard than Ichthyosaurus. In some respects it resembled the latter; thus, it lived in the sea, had a smooth skin, and swam about by means of paddles. Hence, on account

of these likenesses it has been classed with *Ichthyosaurus*, but really it is a very different animal and belongs to a very different division of reptiles. The first and most obvious difference between the two animals which strikes us is that, while *Ichthyosaurus* had the shortest of necks, *Plesiosaurus* had the longest; the neck being almost as long as the body and tail together, and was, in fact, $\frac{5}{3}$ of the whole length. Then, again, while the tail was long and powerful in *Ichthyosaurus*, in *Plesiosaurus* it was short and weak, but correlated with this deficiency was the size of the paddles, which were much larger proportionally, and much more powerful in the latter than in the former.

Plesiosaurus was well adapted to its environment, but not in quite the same way as *Ichthyosaurus*; the latter was capable of making swift movements; the former was not so swift a swimmer, not possessing a long, powerful tail. Its long neck, too, no doubt impeded its progress through the water, but at the same time, owing to its length and flexibility, *Plesiosaurus* could dart its head this way and that, in all directions, after the creatures which formed its food.

Ichthyosaurus seems to have been very active, swimming about not only in the shallow seas, but also out into the open ocean and deep water. *Plesiosaurus*, on the other hand, seems to have preferred shallow water, where it lay lurking among the weeds, and concealed by them both from its enemies and its prey. From its ambush *Plesiosaurus* could dart forth its head, to seize with its sharp, recurved teeth some passing fish or cuttle, or from time to time raise it to the surface to draw air into its lungs.

Now let us consider the structure of this reptile in reference to that of others. If we know little or nothing about the ancestors of *Ichthyosaurus*, we know a great deal of those of *Plesiosaurus*, and can assign its position in the animal kingdom with some certainty.

If we look at the bones in the paddle of *Plesiosaurus* (Fig. 8), we find that they are distinctly modified for swimming purposes: the bones are all flattened and placed close together, and were covered by a single sheet of membrane as in *Ichthyosaurus*, so that there were no separate fingers. At the same time, we can see that the paddle is much more like the limb of a crocodile than is the paddle of *Ichthyosaurus*; for the humerus is well developed, the ulna and radius are quite recognisable, as also are the wrist and palm bones; after the latter come five rows of finger bones, never six or seven, as in *Ichthyosaurus*.

An inspection of the paddle of *Plesiosaurus*, then, makes

it clear that the structure is by no means primitive ; it is obviously modified and secondary, and this inference is confirmed by the fact that in Triassic strata, in rocks, that is, which are older than those in which the fully developed Plesiosaurs are found, there occur the fossil remains of creatures which are in process of becoming Plesiosaurs. These animals have a little head placed on the end of a long neck, just as in Plesiosaurus, and resemble them in other ways, but in the character of the limbs they are somewhat different. In one animal (*Neusticosaurus*) (Fig. 10) the fore-limbs are modified as paddles, just as in Plesiosaurus ; while the hind-limbs are like those of other reptiles, that is, each hind-limb is made up of five well-formed fingers, each enclosed in a finger-stall of skin, and each having a claw at the end. *Neusticosaurus* is half a Plesiosaur, we might say. Another animal (*Dactylosaurus*) (Fig. 9) has the long neck and small head, but in it both the pairs of limbs have the usual reptilian characters. *Dactylosaurus* is, in fact, a lizard which is a quarter the way to being a Plesiosaur. It seems plain that the ancestors of the Plesiosaur were carnivorous lizards which took to living in the water. In adaptation to their mode of life, the neck became lengthened, while the bones of the limbs became flattened ; the fingers and toes became first webbed, then completely covered in with membrane, until at last the paddle of the Plesiosaurus was developed.

(*To be continued.*)

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

FOURTEENTH ANNUAL MEETING AT DUDLEY,

ON TUESDAY AND WEDNESDAY, OCTOBER 13TH AND 14TH, 1891.

PRESIDENT:—G. H. CLAUGHTON, ESQ.

HON. SECRETARIES :

Birmingham .. LAWSON TAIT, LL.D. M.D., F.R.C.S.

Dudley { W. MADELEY.
W. WICKHAM KING.

PROGRAMME OF PROCEEDINGS.

TUESDAY, 13TH OCTOBER.

The members of the Council will assemble at the Dudley Institute at one p.m.

THE ANNUAL MEETING

will be held at 1 30, in the Committee Room, Dudley Institute. The report of the Council and the Treasurer's accounts will

be received, and the place of the next annual meeting will be proposed. Any suggestions from members will be considered, and all necessary business and discussion of work for the coming year will be transacted.

It has been arranged that at three p.m. carriages (1s. 6d. each person) shall be in readiness at the Dudley Arms Hotel to convey members and their friends to Oakham, whence they will walk on the Rowley Hills. Some of the quarries of basalt will be examined, and instances will be shown where the basalt has been intruded among the coal measures, charring and indurating the coal and shale. The fine exposure of columnar formation at Cox's Rough, described and figured by Mr. Jukes in his "Memoir on the South Staffordshire Coalfield," will also be examined, and will be found well worthy of a visit. A number of minerals found associated with and microscopical sections of the basalt will be exhibited during the evening. It will be arranged that members return in time for dinner at 5 30, at the hotel stated on the ticket sent, which will be 2s. 6d. each person.

RECEPTION ROOM.

The room leading out of the Museum at the Dudley Institute will be set aside for the convenience of visitors, and letters may be addressed there.

A luncheon will be provided at 12 30 p.m. at the Dudley Arms. Tickets 1s. 9d. each. Early application is requested.

THE CONVERSAZIONE.

The Conversazione will be held in the Public Hall, Dudley Institute, from seven to ten p.m.

The Dudley and Midland Geological and Scientific Society and Field Club has arranged for exhibitions of objects of scientific interest by its members and by the members of other societies of the Union. There will be a number of microscopes and other scientific instruments. The Society will be much obliged for the loan of microscopes, instruments, or objects from the members of the Union.

In connection with the excursions, Professor Lapworth will give an address on the "Geology of the Dudley District, with especial reference to the Dudley Caverns, &c." Mr. Madeley will make some observations on the fine collection of Crinoids in the Museum.

Arrangements have been made for selections of instrumental music to be given during the evening. Tickets, 2s. 6d. each. Evening dress optional. Carriages to be ordered at ten p.m. A train to Birmingham (G.W.R.) departs at 10 37, arriving at 11 7. Tickets to the Conversazione will entitle the holder of same to visit the Caverns next day.

WEDNESDAY, 14TH OCTOBER.

EXCURSION.

There will be an excursion of great geological, botanical, and archæological interest, under the guidance of members of the Dudley Society thoroughly acquainted with the district, which will include visits to

- I. The Dudley Castle Limestone Caverns and Dudley Priory.
- II. The Wren's Nest.
- III. The Clay Croft Open Coal Work.
- IV. Baggeridge Woods and Himley Park.

All by special permission of G. H. Claughton, Esq., on behalf of the Right Hon. the Earl of Dudley. The route, although it commences in the Black Country, embraces towards the end some of the most beautiful spots in the neighbourhood, which are only accessible by special permission and arrangement. The party will assemble in the Dudley Castle Courtyard on the arrival of the train from Birmingham at 9 30 a.m. Thence the party will walk to the Limestone Caverns, which will be illuminated by the kindness of the Earl of Dudley. Thence the walk will be to the Priory, and then carriages (2s. each person) to the Wren's Nest, where a bread and cheese luncheon will be provided.

As much as possible of the old limestone workings will be seen on the way, and especially the large galleries open on the east side, commonly called the Daylight Caverns, which are extensive, and produce a striking effect. The various sections of the hill, and the modes of working the limestone, will be explained.

From the foot of the Wren's Nest the carriages will take the party to the Clay Croft Open Work, where a very large area of thick coal (twelve yards in thickness), forming a complete basin, will be seen all uncovered at one time, as well as enough of the underground working to show the mode of getting coal. The whole distance to be walked up to this point will be about two miles.

From the Clay Croft Open Coal Work the carriages will take the party to the quarries in the Aymestry Limestone at Sedgley. From Sedgley Beacon, if the weather is fine, there is an extensive view—quite close is the Western Boundary Fault of the South Staffordshire Coalfield, on the other side of which the formations are Permian and New Red Sandstone, extending over the whole area from the Western Boundary Fault to the Shropshire Coalfield. Whether the Coal Measures underlie the New Red Sandstone and Permian which fills this valley, is a question of much interest.

The party will be conveyed back to Dudley in time for a meat tea at the Saracen's Head (2s. per head), at 4 30 p.m.

A sketch and plan, with descriptive account of the Open Work, Wren's Nest, Priory, and Castle, &c., will be provided for all those intimating their intention of joining the excursion.

Members who intend to join the excursion will greatly assist the committee in making adequate arrangements by at once intimating how many tickets they will require for themselves and friends not members of the Union to Mr. W. Wickham King, Pedmore House, Stourbridge, not later than Thursday, October 8th, together with the amount for the tickets, which will be sent on receipt of same.

Members who cannot procure accommodation at Dudley can arrange to stay at Birmingham, which is within half an hour by train. Hotels at Dudley are the Dudley Arms and Old Bush.

The Dudley and Midland Geological and Scientific Society and Field Club cordially invites members of Natural History and Scientific Societies and their friends to the Dudley meetings of the Union.

BURMA AND ITS PEOPLE.

BY A. W. WILLS.

(Continued from page 199.)

The numerous stations are crowded with Burmese in their bright dresses, Tamuls and Madrasees from India, Shans and Karens from the mountains, ubiquitous Chinamen with their packs. Now and then, as the train stops towards evening, a Mussulman native of India steps from his carriage, spreads his mat on the ground, and, turning to the setting sun, performs his vespers, heedless of the crowd.

The Burmese impart especial vivacity to the scene, for their graceful dress exhibits a score of bright yet tender and delicate hues, and joy and laughter are as universal among these children of the sun as long faces are among the inhabitants of our sombre cities.

At last, after 166 miles of this varied scenery, which it takes twelve hours to traverse, we ran into the fine station of Tongoo, and in another quarter of an hour were installed in the hospitable bungalow over which our daughter and her husband rule.

It is a house of one storey, illustrated in Plate 10, perched upon stout teak pillars, and approached by a double staircase,



CLAREGATE, TONGOO.

the space beneath being coach-house, conservatory and store-room. A broad verandah affords access to the various rooms, and broad, overhanging eaves give shade throughout the day. The front is covered with creepers, scarlet *Ipomœas* and blue *Clitorias* climbing to the roof and mingling with a much prized English honeysuckle.

In the garden are English roses growing side by side with *Crotons*, *Allamandas*, *Eucharis*, and various species of *Hibiscus*.

Annuals such as we cultivate at home, *Zinnias* and *Phloxes*, for instance, flourish alongside of *Vanda teres*, the beautiful *V. cœrulea* and rare *Dendrobies* which we nurse with so much care in our stoves.

Vegetables, too, such as carrots, beans, parsnips, and cabbages, are grown with success but not without labour, for already four months have passed without rain, and two pani-wallahs are busy from early morn to dewy eve in carrying water to the garden from the River Sittang, which flows a few hundred yards away.

In these parts one rises betimes in the morning, for the moment the sun appears above the distant hills his rays smite hard, and before 7 a.m. the thermometer stands in deep shade regularly at from 80° to 82° Fahr. Chota hazri, light early breakfast (of coffee, bread and butter, and fruit, such as papaws, custard apples, and delicious oranges from the Shan Hills), is soon despatched; and then we turn out for our morning drive, our heads well protected by huge sola topees. Already the roads are alive with people, labourers are on their way to till the fields, or are driving teams of patient white oxen along the streets.

At frequent intervals one meets a Hpoongyee in yellow robe, bearing his two alms-bowls of lacquered wood suspended from the ends of a bamboo pole, or accompanied by a boy who carries them. Presently he stops before a cottage, but speaks not a word. Then one of the inmates emerges and deposits in one of the bowls a plate of rice, a bundle of sugar-cane, a fruit or a cake, and retires; the monk receives the gift in silence, and passes on to the next house. Thus do these simple brethren still obey the precept delivered by Gautama to his first disciples twenty-three centuries ago, "Let your food be broken victuals given as alms."

A sufficiency having been collected, it is carried to the Kyoung, where it serves a treble purpose as food, first, for the Hpoongyees of the brotherhood; second, for the numerous pupils in their day schools (for they are the national schoolmasters of the country, and this is their only remunera-

tion); and third, for any wayfarer who may claim shelter for the night at the Zyat or rest-house attached to the monastery. I do not attempt to describe the quaint architecture of these Kyoungs, or the strange conventional dragon and serpent sculptures (chinthays) which always surround them, because the numerous photographs which I took during my stay in Burma, sufficiently illustrate their peculiarities.

Then one meets many a charming group of girls going or coming to or from early market, basket on head and cheroot in mouth (for everyone from five years old and upwards seems to have a weakness for the fragrant weed in this country), their jet-black hair worn in a coil on the top of the head and often decorated with a white or scarlet flower. Daintily coloured robes do not conceal the movement of limbs to which an ungraceful attitude seems impossible, and as they pass along under shadow of palm and bamboo and forest tree, a ripple of merry voices marks their way.

Here and there irrigation is being carried on in the fields; and in the roads, where cottages are scattered about and almost buried in tropical vegetation, trades and handicrafts of a simple kind may be seen in full swing in the open air—the blacksmith at his fire, the potter moulding his vessels or carrying them to his primitive kiln, or women dyeing and spinning silk or weaving it into fabrics.

By about 9 a.m. prudence suggests a retreat, for the sun smites hard out of a heaven which is as brass above us, so we turn homeward, always reluctantly enough.

Then comes the grateful morning tub, and, at noon, the welcome tiffin; after which each of our party engages in whatever occupation he wills till afternoon tea is served in the verandah, about which time the languid movement of a leaf here and there proclaims the approach of the evening breeze. From five to seven a drive round the well-kept cantonments, or to the Tongoo lakes, is always delightful. An illustration of a street in Tongoo is given in Plate 11.

At such times we often came upon a group of Burmese youths gathered at some open space for the practice of the national game of ball, in which a sphere of wicker-work, about six inches in diameter, is kept going entirely by the feet, the kick being given either from the instep or backward from the heel, with marvellous dexterity, the ball being driven high into the air and often cast from one to another of the players fifty or sixty times before it falls to the ground.

As darkness comes on—and there is scant twilight so near the equator—lights begin to twinkle among the trees and groups gather around fires which are kindled outside the



A STREET IN TONGOO.

cottages to chat over the evening cheroot. Little stalls are set up at street corners, on which cooked rice, sugar cane, cigars, and other trifles are exposed for sale to the passer-by, and curious cakes, like magnified pancakes of extreme thinness, are cooked dexterously over wood fires.

The streets are alive with people passing to and fro, or sitting on their heels about the stalls, laughing, chatting, and enjoying the coolness of the evening. Every now and again the air is rich with the heavy scent of a *Pancratium*, or of the *Sathapoo*, the male flower of the *Pandanus* or Screw Pine. In one street, inhabited mostly by Chinamen, we always saw lighted lamps burning before quaint representations of their deities as we passed the open houses, and their Joss-house stood in close juxtaposition to an Indian temple and to Burmese pagodas, for Buddhism is a liberal creed, and all forms of worship have ever been freely tolerated in this land.

Not unfrequently preparations were being made for a *Pooe* (pronounced *Pooey*), or theatrical representation, in which the Burmese take especial delight, the stage being set in some field by the wayside, or even at the junction of three or four roads, the temporary interference with the traffic being accepted as a matter of course. Such performances are given either by some rich individual or by subscription among the inhabitants of some particular part of a town, and in times past fierce faction fights have arisen out of the rivalry of different quarters in regard to the superior quality of this or that theatrical company.

We were fortunate enough to see a *Pooe* of exceptional merit at Tongoo, the performers being specially brought from Mandalay, or I should rather say a portion of one, for the entertainment begins about 8 p.m., and is only brought to an end by returning daylight.

In the middle of an open space surrounded by clumps of bamboo and tall cocoa-nut palms, was erected an awning of mats covering an area of perhaps forty or fifty feet square. Beneath was the stage, some twenty feet square, and consisting of a few mats laid on the turf, and in the centre were two rude pillars of stone or brick, each a couple of feet square and three feet high, on the top of which were two earthen bowls in which crude mineral oil was blazing. These served as foot-lights and illumination of the house at the same time, and were replenished from time to time by one or other of the performers out of a reserve tin by means of a wooden ladle.

Behind the stage was a large wooden chest, the wardrobe of the company, from which, during the progress of the

piece, new costumes were taken at intervals; and on our right of it, almost lost in the dim and smoky light, stood the orchestra, consisting of numerous drums, arranged round the inside of a circular wicker-work pen and played by a man standing in the centre, fifes and horns, which emitted sounds suggestive of bagpipes, castanets, &c.

The front rows of the audience were squatted close round the square space which served for stage, and behind them sat and stood tier upon tier of spectators, men, women, and children, to the number of several thousands, the whole assemblage being girdled round by three or four rows of bullock carts, which had brought their owners in to the play from villages around, the cattle being tethered outside within easy reach.

The *dramatis personæ* consisted of two clowns, several princes, a Woon, or Minister of State, and two princesses, and the piece was an elaboration of one of those almost endless Eastern stories in which youthful princes roam the world in search of mates who are to be paragons of beauty and virtue, and encounter manifold adventures by land and water in the process, in which evil spirits, false Hpoongyees, and wild beasts play a prominent part.

The greatest attraction in the performance seemed to consist in the dancing of the princesses. These ladies were richly bejewelled, and wore close-fitting silken robes of delicate colours, and of such length that they encompassed the feet in an amount of drapery which would make dancing of any European fashion entirely impossible. Their movements were in fact a series of posturings in which the head was thrown back and the arms and body contorted into the largest possible number of angles of which the human frame is capable after long training. Each ballet, if one may use the term, ended by a remarkable performance, the *danseuse* bending the knees and gyrating rapidly by a succession of quick, pattering steps, and then suddenly springing up to her full height and gliding to the edge of the stage, where she lay down at the feet of the front row of spectators and lighted her cheroot, amid the applause of the audience.

The vast crowd made way for us to pass on our arrival at the Pooe, and we were ushered to seats of honour close to the performers. After watching the piece for a couple of hours we rose to leave, and again, as if by magic, a way was opened for us, and we made our exit finally through the surrounding fringe of carts into the open space. Already this was dotted over with recumbent figures, each wrapped in its long robe. These were spectators who, after watching the play for some

hours, were refreshing themselves with a nap previous to returning for another spell of the performance.

After the evening drive comes dinner, a good square British meal, served by noiseless Indian "boys" in white garments; thereafter music, conversation and so forth, till bed time, and then, after careful adjustment of the necessary mosquito net, one sleeps soundly with open doors and windows till the rising sun proclaims that another day has dawned.

So passed our days at Tongoo, all too swiftly, each bringing nearer the time when we must once more say "farewell" to our children—yet by no means without variation.

Native musicians, conjurers and snake charmers visited the house from time to time and formed subjects for the camera; and there was no lack of hospitality or of pleasant society among the civil and military officers, the latter being attached to two wings of British and native regiments quartered in the splendid barracks and cantonments which skirt the fine Maidan, or parade ground, of this important station.

Moreover, we had excursions into the jungle, visited the saw mills of Kanyut Gwyn, where we saw elephants stacking the timber logs in great piles and, lastly, spent a week in Mandalay, the "Golden City," in which Theebaw once reigned, and which is now the capital of our Upper Province annexed in 1886.

Fourteen hours are occupied in this journey of 200 miles. The line passes in turn through native villages, English military posts, forest and jungle, dreary wastes where for many miles the arid soil yields nothing but dense growths of cacti and again through tracts of well wooded and highly cultivated country, in which as many as three crops of paddy are harvested in the year.

Here, as darkness comes on, you see, by the light of fires flickering among banyan and pipul trees, teams of oxen treading out the grain, just as it was done when the Pharaohs ruled in Egypt or Assyrian monarchs in Nineveh. Throughout this region of Upper Burma we noticed with satisfaction that the stockades by which every village was formerly protected from sudden attack are being allowed to fall into decay, being now no longer needed. It is true that armed police guards still patrol the railway stations on arrival of the trains, but this is rather a reminder of the settled order which prevails than a necessity, and the number of Shans and Karens, with an occasional member of some more remote tribe, a Shanthoo, Paloung or Padoung, who mingle with the lowlanders at every roadside station, shows how rapidly the country is being opened up, and how strongly the feeling of general security is taking possession of its inhabitants.

(To be continued.)

PROGRESS OF THE WARWICKSHIRE PHOTO-SURVEY.

Since the publication in these pages of Mr. Jerome Harrison's plan for conducting a local Photographic Survey, good progress has been made on the lines then indicated. The Birmingham Photographic Society has directed the attention of its members mainly to the Hundred of Hemlingford, which embraces the northern division of the county. Some hundreds of negatives of points of interest in this area have been secured—churches, manor-houses, cottages, village streets, geological sections, etc.

Three processes are now known by which *permanent* prints can be produced from photographic negatives. These are (1) Carbon prints; (2) Platinum prints; and (3) Bromide prints. It has been resolved to accept such prints only for the purposes of the Survey.

The work of the Survey has lately received an impetus by the return of Mr. J. B. Stone from his tour in Japan and round the world. Mr. Stone took with him more than one camera, and he has secured a great number of pictures of objects of interest; his views of volcanic phenomena being especially novel and remarkable. Under his direction the Warwickshire photographs are now being collected by the local committee for the purposes of mounting and arrangement. It is intended that one complete set shall be placed at the disposal of the municipal authorities, but before this is done we trust that it is possible that they may be publicly exhibited. Every worker for, or on, this Survey deserves great credit for the efforts which are being made to obtain a faithful pictorial record of the state of Warwickshire during the last decade of the nineteenth century. Messrs. S. G. Mason (treasurer), J. H. Pickard (hon. secretary), J. T. Mousley, J. Simkin, E. Underwood, A. J. Leeson, with many others, have worked, and are working, hard at the matter; and in another number we hope to give some details of the work done by each contributor of prints to the Survey portfolios, with lists of their subjects, etc.

HISTORY OF THE COUNTY BOTANY OF WORCESTER.

BY WM. MATHEWS, M.A.

(Continued from page 189.)

* *Veronica polita*. Tab. 21. Sparingly in all the districts.

* *V. Buxbaumii*. Tab. 21. *Not native*. Established in all the districts.

- * *V. hederæfolia*. Tab. 21. In all the districts.
- * *Orobanche Rapum*. 6, Warshill; 18, Shrawley Wood; 86, Malvern D.; 115, Lickey D.; *Clent Hill, 1854, Wm. M.* Tab. 20. Severn, Malvern, Lickey.
- †* *O. elatior*. 68, 73, clover field at Great Malvern, Miss Moseley; 94, fields of clover, List in May's "Evesham." *Previously queried. O. elatior is parasitical on Centaurea Scabiosa.* Tab. 20. Avon, Malvern.
- * *O. minor*. Among clover at Lower Wick, 1849. Tab. 20. Avon, Severn, Malvern.
- * *Lathræa squamaria*. 6, near Bewdley; 68, 81, 86, Malvern D.; 122, 128, Wychbury Wood. Tab. 20. Severn, Malvern, Lickey.
- * *Verbena officinalis*. Tab. 23. In all the districts.
- * *Mentha rotundifolia*. 6, near Bewdley, Jorden; 49, roadside, near Stone, Kidderminster; 86, Malvern D. Tab. 21. Severn, Malvern.
- * *M. sylvestris*. 6, 13, 49, Severn D. Tab. 22. Severn, Malvern.
- * *M. viridis*. 6, 13, Severn D.; 86, Malvern D.; 123, Lickey D. Severn, Malvern, Lickey. *Not native.*
- * *M. piperita*. 6, 49, Severn D.; 65, Malvern Chase. Tab. 22. Avon, Severn, Malvern.
- * *M. aquatica (hirsuta)* and vars. Tab. 22. In all the districts.
- * *M. sativa*. Tab. 22. Sparingly in all the districts.
- * *M. rubra*. 86, Malvern D.; 97, Avon D. Not in Tab.
- * *M. gentilis*. 6, near Bewdley. Not in Tab.
- * *M. arvensis*. Tab. 22. In all the districts.
var. *agrestis*. 6, near Bewdley, Jorden. Not in Tab.
- * *M. Pulegium*. 6, 13, Severn D.; 65, Malvern Chase; 115, Lickey. Tab. 22. In all the districts.
- * *Lycopus europæus*. Tab. 22. In all the districts.
- * *Salvia verbenaca*. 60, on the red marl about Worcester; 98, Alderminster, Mr. Cheshire. Tab. 22. In all the districts.
- * *Thymus Serpyllum*, Fries. 7, Bewdley. Tab. 22. In all the districts.
- * *T. Chæmædrys*. Fries, 7, Bewdley. Tab. 22. Severn, Malvern, Lickey. *No doubt also in Avon.* First pointed out as a British plant by the late Mr. George Jorden, of Bewdley, in 1848.
- * *Origanum vulgare*. 6, Wyre Forest; 86, Malvern D.; 93, Cracombe and Coldknap Hills, near Evesham; 10, Bredon Hill. Tab. 22. Avon, Severn, Malvern.
- * *Calamintha Clinopodium*. Tab. 22. In all the districts.
- * *C. Acinos*. 6, 13, 59, Habberley Valley and Blakedown; sandy spots near Kidderminster and Stourport; 97, between Evesham and Elmley Castle, Mr. Cheshire; 100, 101, Bredon Hill. Tab. 22. Avon, Severn, Malvern.
- * *C. officinalis (menthifolia)*. Tab. 22. Avon, Severn, Malvern.

- †* *C. Nepeta*. 97, shrubbery at Fladbury, near Evesham; H. New, in May's "Evesham"; "Mid. Nat.," Vol. XIII., p. 132. Tab. 22. Avon. *I suspect an error.*
- † *C. sylvatica*, Bromfield. 50, gathered by the late Dr. J. M. Streeten, of Worcester, on Abberley Hill, 16th August, 1844, and referred by him to *C. grandiflora*, Mœnch. In the Herb. Wor. Nat. Hist. Soc. Tab. 22. *First record.*
- * *Melissa officinalis*, xxx. Tab. 22. *Not native.*
- * *Scutellaria galericulata*. Tab. 22. In all the districts.
- * *S. minor*. 6, 11, 13, 60, Severn D. 119, formerly at Moseley.
- * *Prunella vulgaris*. Tab. 22. In all the districts.

(To be continued.)

THE FUNGI OF WARWICKSHIRE.

BY W. B. GROVE, M.A., AND J. E. BAGNALL, A.L.S.

(Concluded from page 211.)

ORD. VIII.—TRICHOCASTRES.

GEASTER. Mich.

647. *G. fornicatus*, Fr. *Lycoperdon fornicatum*, Huds., With. Meadows and pastures. Very rare. October to January. About Birches Green, near Birmingham, Mrs. Corrie in With. 368.
648. *G. limbatus*, Fr. *Lycoperdon stellatum*, Linn., With., Purt. Hedgebanks and pastures. Rare. September to December. Hedgebank by the side of the great road from Coventry to Birmingham, near Stonebridge; in Edgbaston Park, With. 367. Rushford; Oversley, Purt. ii. 702. Allesley, Bree in Purt. iii. 480.
649. *G. fimbriatus*, Fr. Fields. Rare. December. Station Fields, Kenilworth, 1871, Russell, List. In a garden Boldmere, near Sutton, 1888.
650. *G. rufescens*, Fr. Pastures. Rare. Oct. Pasture on the farm of the Earl of Warwick (Heathcote Farm), 1872, Perceval.

BOVISTA. Dill.

651. *B. nigrescens*, Pers. Pastures. Not common. In a field near Shustoke, 1888.
652. *B. plumbea*, Pers. Pastures. Local. Fields near Maxstoke Priory.

LYCOPERDON. Tourn.

653. *Lycoperdon Bovista*, Linn. *L. giganteum*, Batsch. Pastures and gardens. Not common. August to October. Ansty, Adams. Olton Reservoir! Parsons, Edgbaston! Hillhouse. Sutton; Wixford; Castle Bromwich.
654. *L. cælatum*, Bull. Edible. Pastures. Not common. July to October. Corley, Adams. Packington Park;

- Coleshill Heath; Edgbaston Park. This species is as delicious, when fried in slices, as *L. giganteum*.
655. *L. saccatum*, *Vahl*. Borders of woods. Rare. October. Knowle, 1886, *Hawkes*!
656. *L. gemmatum*, *Batsch*. Meadows and waysides. Common. September to November. Kenilworth, *Russell, Illustr.* Ansty, *Adams*. Alveston Pastures; lane by Crackley Wood; Haywood; pastures near Maxstoke Priory; Coleshill Heath; Olton Reservoir, &c.
657. *L. perlatum*, *Pers*. Roadsides by woods. Common. September-October. Coleshill Pool; New Park, Middleton; Corley; Forge Mills, &c.
658. *L. pyriforme*, *Schæff*. On decaying logs or on the ground near them. Frequent. Oct. to Feb. Abbey Fields, Kenilworth, *Russell, Illustr.* Warwick, *Perceval*. Ansty; Hopsford, *Adams*. The Spring, Kenilworth; Olton; Middleton; Maxstoke; Shustoke; Sutton; Edgbaston Park, &c.
659. *L. Cookei*, *Mass*. On the ground. Rare. August-September. Edgbaston Park, 1886; a large number growing together, distinguished from *L. pusillum* by the well-developed cellular sterile base.

SCLERODERMA. *Pers*.

660. *S. vulgare*, *Fr*. Woods. Frequent. Autumn. Warwick, *Perceval*. Hopsford; Combe, *Adams*. Sutton Park: Kingsbury Wood; Middleton; Hartshill Hayes; Oldbury Woods; Waste Wood, Tile Hill; Haywood; Cut-throat Wood, Solihull; Alveston Pastures; Crackley Wood; Coleshill Pool; Olton, &c.
- Var. *spadiceum*, *Pers*. *Tuber solidum*, *With*. Edgbaston, under an oak tree by the pool, *With*. 365.
661. *S. Bovista*, *Fr*. On the ground. Rare. November. Kenilworth, *Russell, Illustr.* Warwick, *Russell, List*. (Is not this an error?)
662. *S. verrucosum*, *Pers*. *Lycoperdon*, *With*. *L. defossum*, *Purt*. Hedgebanks. Rare. August to October. Edgbaston, by the little pool dam, *With*, 372. Oversley; Kinwarton, *Purt*. ii. 761. [A few specimens at Sparkhill, just outside the county, October, 1882.]
663. *S. Geaster*, *Fr*. On the ground, in woods. Rare. Nov. On marly soils in New Park, Middleton, Nov., 1882.

ORD. IX. NIDULARIACEI.

CYATHUS. *Hall*.

664. *C. striatus*, *Hoffm*. *Nidularia striata*, *Purt*. On sticks and stumps. Rare. July to September. On a hedge-bank in Oversley Lane; in a wood near Cold

Comfort, *Purt.* ii. 693. Banks, Allesley, *Bree in Purt.* iii. 470. Hopsford, *Adams.* On a beech stump in Packington Park, July, 1886.

665. *C. vernicosus*, *DC.* *Nidularia campanulata*, *With.*, *Purt.* Woods, gardens, and fields. Rare. September-October. In the garden of the workhouse at Erdington, *With.* 350. Kinwarton, *Purt.* ii. 693. In a garden at Sutton, and in Mr. Levick's garden at Aston. "Call'd in *Worcestershire*, Cornbells, where it grows plentifully," *Ray, Syn.* p. 20.

CRUCIBULUM. *Tul.*

666. *C. vulgare*, *Tul.* *Nidularia lævis*, *Purt.* On ferns, sticks, &c. Rare. Autumn and winter. Near Coleshill, on a decayed fern stalk, *Bree in Purt.* iii. 267. Warwick, *Perceval.* Combe Ridings, *Adams.* Near Erdington, August, 1888.

SPHÆROBOLUS. *Tode.*

667. *S. stellatus*, *Tode.* *Lycoperdon carpobolus*, *With.* On rotten sticks, &c. Rather rare. June to November. Packington, *With.* 271. Driffold Lane, Sutton; New Park, Middleton; Bradnock's Hayes; Edgbaston Park; Olton Reservoir, &c.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GEOLOGICAL SECTION, August 18th. Mr. Pumphrey (president) in the chair. Mr. W. B. Grove exhibited *Oxyria reniformis*, *Cochlearia Danica*, *Carduus heterophyllus*, from Glencoe, *Juniperus nana* from Goat Fell, *Salix herbacea* (Glencoe), *Lycopodium selaginoides*, and also specimens of rock from summit of Ben Nevis. Mr. W. Hodgson exhibited some fossil specimens from the Wren's Nest and Open Coal Working obtained during recent excursion to Dudley.—MICROSCOPICAL SECTION, September 1st. Mr. C. Pumphrey (president) in the chair. Mr. S. P. Bolton exhibited *Leptodora hyalina*, *Dendrosoma radians*, and *Ophrydium* —? Mr. T. V. Hodgson exhibited *Limnias ceratophylli*, *Zoothamnium arbuscula*, and other vorticellidæ. Mr. W. B. Grove exhibited *Lennea polyrhiza* and *Peronospora infestans*. All these were collected on the recent excursion to Solihull. Mr. Grove also exhibited a large number of fungi, among which were *Lentinus cochleatus*, *Agaricus sinuatus*, and *A. incanus*. Mr. J. Levick then gave a brief account of his trip to Ben Nevis and neighbourhood.—BIOLOGICAL SECTION, September 8th. Mr. C. Pumphrey, president, in the chair. A dish of fungi, *Cantharellus cibarius*, cooked by Mr. W. B. Grove, was handed round for the members to taste. Mr. Grove also exhibited the following fungi from Kenilworth:—*Agaricus acervatus*, *Ag. fragrans*, *Ag. ammoniacus*, *Cortinarius purpurascens*, *Russula rosacea*, *Craterellus cornucopioides*, *Peziza hemispherica*, and *Sphærella rumicis*. Mr. W. R. Hughes, F.L.S., exhibited the following plants from the

Cotswolds, gathered in the neighbourhood of Minchinhampton: *Campanula glomerata*, *Gentiana amarella* (abnormal form), *Chlora perfoliata*, *Hypericum calycinum*, *Lithospermum officinale*, *Carlina vulgaris*, *Solidago Virgaurea*, *Epipactis latifolia*, *Monotropa hypopitys*, *Colchicum autumnale*, *Geranium Robertianum* (white variety), *Orobancha minor* (on clover), *Euonymus europæus*, and *Verbascum nigrum*. Mr. T. V. Hodgson exhibited the following fungi, collected on the Society's excursion to Bewdley: *Agaricus rubescens*, *Ag. arvensis*, *Ag. procerus*, *Boletus luridus*, *Lycoperdon cælatum*, *L. saccatum*, *Clavaria coralloides*, and *C. cristata*. Mr. C. J. Watson exhibited hairs of *Tradescantia virginica*, and some photographs of Llanberis and Bridgnorth. — GEOLOGICAL SECTION, September 15th. Mr. Waller in the chair. Mr. Watson exhibited gypsum from Penarth and copper ore from Snowdon. Mr. Grove exhibited *Cortinarius collinitus* from Barnt Green; also (for Miss Gingell) *Clavaria pistillaris* and *Ag. odoratus* from Minchinhampton; also (for Mr. J. E. Bagnall) *Pogonatum urnigerum* from a quarry near Meriden, new to Warwickshire.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—July 20th. SPECIAL: BOTANY. Mr. H. Hawkes showed a series of beautifully prepared microscopical slides to illustrate Bowers and Vine's "Practical Botany." Mr. J. Madison showed a living stickleback from the Corporation water tap in his house.—July 27th. Mr. Parker exhibited a collection of plants from Northfield, including a fungus, *Polyporus squamosus*, and leaves of Burnet, showing different stages in the development of *Xenodochus carbonarius*. Mr. H. Hawkes a collection of echini, starfishes, &c., from Scarborough, also a fungus, *Polyporus intybaceus*, from Arley. Mr. J. Collins, plants from Arley; Mr. J. W. Neville, specimens of *Sirex gigas*, also a slide of dissections of the ovipositor under the microscope; Mr. Hawkes, a zoophyte, *Campanularia plumosa*.—August 10th. SPECIAL: HOLIDAY EXHIBITS. Mr. H. Hawkes exhibited, for Mr. Corbett, specimens of dodder, *Cuscuta europæa*, and other plants from Gloucestershire; and, on his own behalf, he showed a collection of plants from the Chesil beach, Weymouth, and regretted the building of a manufactory there on a piece of land noted for the richness of its flora; Mr. J. W. Neville, a small collection of marine shells, mostly showing young forms; Mr. Linton, the different varieties of pecten found at Tenby; Mr. Spears, specimens of calcareous tufa from near Halesowen; Mr. G. H. Corbett described a section of the Keuper marls, with the Rhætic beds overlapping them, at Westbury-on-Severn, and showed fossils and crystals from the district. Under the microscopes, Mr. Hawkes showed hooklets of *Cobea scandens* and *Sphacelaria plumosa*; Mr. W. J. Parker, skeleton wheel-bearer, *Dinocharis pocillum*.—August 17th. Mr. H. Hawkes exhibited a series of fungi collected in the Rowington district, and remarked on their edible and non-edible qualities, also plants from the same district; Mr. S. White, a series of plants from Cooper's Hill; Mr. G. H. Corbett, teeth, &c., of fossil fish, *Megalichthys Hibbertii*, from the carboniferous limestone, Prestatyn. Mr. P. T. Deakin then read a paper, "Notes on Some Land Shells from Brittany." The writer said the shells of which he should speak were gathered by a friend who was not a conchologist, or he might have collected specimens of more scientific interest. A glance would show that they were almost identical with our own. They were collected on the stone walls, and comprised thirteen species. The different shells were enumerated, and their varieties and distribution enlarged upon. The specimens of *Helix aspersa* were variable in shape but not

in colour. The writer said the study of these shells favoured the supposition that this country joined France by way of Cornwall, a strong resemblance being seen in the land shells of central Wales and western France, Spain, and Africa. The shells were exhibited at the meeting.—August 24th. Mr. Lilley exhibited a collection of land and freshwater shells recently made in the Towyn district; Mr. Linton, a collection of marine shells from Tenby; Mr. P. T. Deakin, specimen of henbane, *Hyoscyamus niger*; Mr. J. Moore, a series of nests of ichneumon flies, also nest of Mason wasp, with the wasps and cuckoo-flies that emerged from it; Mr. G. H. Corbett, specimens of *Estheria minuta* in slabs of marlstone from the upper Keuper beds, Shrewley Common.—August 31st. MARINE BOTANY. Mr. H. Hawkes exhibited a series of slides of marine algæ, mounted to show fructification, and described their methods of reproduction, also a small herbarium, including some of the rarer plants of the Canterbury district, and a specimen of an orchis, *Epipactis latifolia*, from Matlock; Mr. J. Collins, a collection of seaweeds from the south coast; Mr. Matley, seaweeds from Llanfairfechan; Mr. P. T. Deakin, a short, thick variety of *Clausilia rugosa* from Towyn; Mr. G. H. Corbett, a glaciated boulder from a well-sinking at Spring Hill.—September 7th. Mr. J. Collins showed a collection of plants made during a botanical tour in North Devon; among many interesting specimens were the following:—*Euphorbia paralias*, *E. hiberna*, *E. Peplis*, *E. portlandica*, *Bartsia viscosa*, *Juncus acutus*, *Viola Curtisii*, *Rubia peregrina*, *Scilla autumnalis*, *Orobanche hederæ*, *Medicago maculata*, and a number of ferns. Mr. H. Hawkes, a collection of plants from Matlock, including *Epipactis media* and *Viola lutea*, also specimens of sundew from Hartlebury Common; Mr. J. W. Neville, leaves of *Spiræa Ulmaria* infested with brand; Mr. Linton, a collection of eggs of the larger sea birds from Tenby.—September 14th. Mr. J. Collins exhibited cleistogamous flowers of *Oxalis Acetosella*, and pointed out their specialised structure to secure self-fertilisation. Mr. W. J. Parker read a paper, "Notes on Natural History." The writer said the importance of taking notes on all subjects that interested us could not be over estimated. The notes read were on various subjects, and made during a number of years. They comprised observations on the time of the falling of the leaf of different trees; the shedding of bark; permanent, fugitive, and intermittent fragrance of flowers; and the age of trees. The notes on bird life dealt with curious nests, the pairing of birds, the bright colours of the males being chiefly confined to polygamous birds. Several notes were read on the mortality among shrew-mice; it had been attributed to several causes, but the writer thought it resulted from their own pugnacity. A discussion on the various opinions closed the meeting.

BIRMINGHAM ENTOMOLOGICAL SOCIETY.—August 17th. Mr. R. C. Bradley in the chair. Mr. G. W. Wynn showed bred series of *Bombyx rubi* and *B. quercus* from Sutton, a single specimen of *Chærocampa porcellus* taken at Sutton last June, a series of *Notodonta dictæa*, bred from larvæ found on Cannock Chase, and a single specimen of *Plusia bractea* from Bewdley. Mr. P. W. Abbott showed long series of *Zygæna filipendulæ* and *Z. trifolii* from the Isle of Wight, including yellow varieties of the former species. Of the latter species, quite seventy-five per cent. of the specimens taken were varieties with the spots more or less coalesced. Mr. R. C. Bradley showed *Scatophaga scybalaria* from Sutton Park. Mr. C. J. Wainwright showed *Phytometra ænea* from Wyre Forest.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

DUDLEY MEETING.

OCTOBER 13TH AND 14TH.

The fourteenth Annual Meeting took place at Dudley on Tuesday and Wednesday, the 13th and 14th of October last. The societies in the Union include—

- The Birmingham Microscopists' and Naturalists' Union.
- The Birmingham Natural History and Microscopical Society.
- The Birmingham Philosophical Society.
- The Birmingham and Midland Institute Scientific Society.
- The Birmingham School Natural History Society.
- The Caradoc Field Club.
- The Derbyshire Archæological and Natural History Society.
- The Dudley and Midland Geological and Scientific Society and Field Club.
- The Leicester Literary and Philosophical Society.
- The Malvern Field Club.
- The Oswestry and Welshpool Naturalists' Field Club.
- The Oxfordshire Natural History Society and Field Club.
- The Rugby School Natural History Society.
- The Severn Valley Naturalists' Field Club, and
- The Tamworth Natural History, Geological, and Antiquarian Society.

TUESDAY, OCTOBER 13TH.

The only regrettable feature in connection with the meeting was the wretched weather which prevailed both days. A capital programme as to amusements and places to be visited had been prepared by the local committee of the Dudley and Midland Geological and Scientific Society and Field Club, but, unfortunately, owing to the provoking weather, some interesting excursions had to be abandoned. The same cause had also a marked effect on the attendance of the delegates from the various societies, which was nothing like so large as was expected. The members of the Union were first entertained at luncheon, provided at the Dudley Arms Hotel, shortly after midday. Following this a Council meeting was held in the committee room at the Institute, and shortly before two o'clock the annual meeting took place. The President of the Union (Mr. G. H. Claughton) occupied the chair. The various societies were represented at the meeting by the following gentlemen:—Birmingham and Midland

Natural History and Scientific Societies—Professor Hillhouse, Messrs. P. H. Levi, C. Pumphrey, W. R. Hughes, F.L.S., C. R. Rolinson, W. Hudson, C. J. Watson, and N. G. Weaver; Dudley and Midland Geological and Scientific Society and Field Club—Messrs. G. H. Claughton, E. B. Marten, H. Johnson, W. Madeley and W. Wickham King (secretaries), H. W. Hughes, T. F. Bland, E. Hollier, and the Revs. J. Hodgson (Kinver). and J. B. Lloyd; Oswestry and Welshpool Field Club—The Rev. O. M. Feilden and Mr. J. Dovaston; Birmingham Philosophical Society—Dr. T. Stacey Wilson; Derby Archæological and Natural History Society—Mr. H. Arnold Bemrose.

The President (Mr. G. H. Claughton) in opening the proceedings, said—As chairman of to-day's proceedings, it is my most agreeable duty to bid you welcome to Dudley in the name of the Dudley and Midland Geological and Scientific Society. That society, gentlemen, knows well what it is about in inviting you to these parts to-day. It has a selfish design on you. It knows the value of criticism, and it knows the truth of what has been well said, that, though much may be learned from books and lonely investigation, yet it is personal contact and mind meeting mind that causes the mental friction which strikes out ideas. Accordingly, gentlemen, we thank you very much for coming amongst us, and we will endeavour to do our best to render your visit as instructive and pleasant as possible. We have some ground to go over second to none in geological interest; in fact it is unique—unique in its treasure of the celebrated thirty-foot seam of coal, commonly called the thick coal; unique in its treasure of Silurian limestone, on the reefs of which the coal measures directly rest, without the usual intermediate old red sandstone rocks, unique as a happy hunting ground for geological students, unique inasmuch as in the limestone caverns a former president of the Dudley society—I refer to Sir Roderick Murchison—was crowned King of Siluria with much pomp and ceremony in 1839. In connection with this date, I may mention that on a recent occasion, being desirous of finding out the correct date of the coronation service, I asked the following simple question through the telephone:—"On what date was Sir Roderick Murchison crowned in the caverns?" After some suspense, I was informed that they were not aware on which day Sir Roderick was *drowned* in the caverns. *Sic transit gloria mundi!* which may be translated, "How truly are mundane matters a nine days' wonder." It might be expected that you should hear from your chairman to-day something of the geology of the

district, and especially of the places to be visited, but a better fate is in store for you. Professor Lapworth has kindly consented to address us this evening on this subject, chiefly as to Dudley geology as exemplified in the underground and open caverns; but also briefly as to their bearing on geological results up to the present date; and in his hands I can promise you a masterly exposition. It will be enough for me to congratulate the members of the Union on the practical use of your knowledge that union is strength; to point out how much science is advanced by the quiet workers in various societies gathered in union to-day; to repeat that the world still makes liberal terms with the discoverers of what may turn out practically useful to it; but (to quote Professor Tyndall) to insist that the guiding spirit must be the love of truth for its own sake, and not the greed of gain. Our local society has suffered in the past, as no doubt have some of yours, by losing an important section, viz., its mining engineers, who, finding that the black diamonds were all-engrossing, formed an independent society and now belong to the Federated Institute of Mining Engineers, representatives of which we have just lately had the pleasure of entertaining. Fortunately, though very energetic, they have not had time to run away with all the interesting rocks of the neighbourhood; so I propose that we make haste and carry out the programme formulated for us by our excellent organising secretary, Mr. Wickham King, assuring you that although we invite criticism, and have an eye to picking your brains, yet we will do our best, weather permitting, to make your visit to prehistoric Dudley as agreeable and interesting as may be in our power.

The following report of the Council was adopted:—

“The Council have much pleasure in presenting their fourteenth Annual Report, and in placing on record that the Midland Union of Natural History Societies maintains a steady and, they believe, a useful existence. It includes, as last year, fifteen Societies, and, whilst the Council express regret that a special circular issued to other Societies not within the Union has not met with the successful response that they had hoped would result from it, yet they are glad to say that the list of Societies included in the Union remains intact, and that the combined number of members within the Union and receiving the ‘Midland Naturalist’ remains quite satisfactory.

“They greatly regret that the Darwin Medal this year, as last year, remains unappropriated, and for the reason that

the subject for this present year—Archæology—did not receive any contribution in the columns of the ‘Midland Naturalist’ of sufficient importance to justify the award. Considering the wide range of this subject, and the large number of persons engaged in its study in the Midland district, this result cannot but be regarded as unsatisfactory.

“Several very prominent members of the Societies within the Union have fallen from within its ranks by reason of death. Prominently amongst these stands a well-known name deserving of more than passing notice. The Council have to express their deep regret at the death of Dr. George Deane, whose distinguished career, especially as a geologist, received a full notice in several of the journals and newspapers of the day. As a teacher and advanced thinker he achieved a great success, and his death is mourned by large numbers amongst the foremost ranks of science who had the privilege of his close personal acquaintance.

“During the past year Mr. Kineton Parkes, one of the honorary secretaries of the Union, received an appointment at Leek, and on his removal to that town felt obliged to resign his position as honorary secretary. The Council recognised the value of his services by passing a vote of thanks. The Council have elected Dr. T. Stacey Wilson to occupy the position as Mr. Parkes’s successor.

“The following important papers have appeared in the ‘Midland Naturalist’ during the past year:—‘Animal Pedigrees,’ by A. Milnes Marshall, M.A., M.D., D.Sc., F.R.S.; ‘Burma and its People,’ by A. W. Wills; ‘The Flora of Warwickshire,’ by J. G. Baker, F.R.S. (of Kew); ‘Dragons of the Prime,’ by A. Bernard Badger, B.A.; continuation of the ‘County Botany of Worcester,’ by Wm. Mathews, M.A.; the continuation of the ‘Fungi of Warwickshire,’ by W. B. Grove, M.A., and J. E. Bagnall, A.L.S.; serial articles on ‘Through Norway with the Vesey Club,’ by W. Hillhouse, M.A., F.L.S.; ‘The Aran Islands,’ by Philip B. Mason, F.L.S., F.Z.S.; the ‘Scope of Sociology,’ by Mary E. Dalton; ‘A Visit to the North Cape and Norway,’ by C. Pumphrey and W. P. Marshall. Other articles are ‘Organic Death,’ by F. T. Mott; ‘Plant Marches,’ by J. B. Stone, F.G.S., F.L.S.; ‘The Birds of Oxfordshire,’ by J. Cordeaux; ‘Notes on a Trip to the Orkney and Shetland Islands,’ and ‘On the Gulf Stream and its Effect upon the Climate and Plants of England and Norway,’ by W. P. Marshall, M.I.C.E.; ‘Personal Observations of Glacial Action among British Mountains,’ by Horace Pearce, F.G.S., F.L.S.; ‘Foramini-

fera of Hammerfest, Norway,' by E. W. Burgess; 'On Crinoids,' by W. Madeley; and 'On a Boring at Shillingford, near Wallingford (on Thames),' by A. J. Jukes-Browne, B.A., F.G.S."

Mr. W. R. Hughes, F.L.S., proposed the re-election of Mr. Lawson Tait, L.L.D., F.R.C.S., as secretary to the Union, and that Dr. T. Stacey Wilson (Birmingham Philosophical Society) be appointed as his colleague in place of Mr. Kineton Parkes, resigned. In the course of his remarks he said he thought their thanks were due to the Dudley Society for inviting them there that day, and for the excellent manner in which they had looked after their interests. He was pleased to say that the Birmingham and Dudley Societies had worked together most harmoniously. They would, he thought, all agree with him that Dudley and district was a most interesting place both pictorially and historically, as well as geologically—and he might also add socially—and he was confident that during their visit they would find plenty to attract and absorb their attention.

Professor Hillhouse (Mason College) seconded the proposition. He remarked that Mr. Lawson Tait was one of the prime founders of the Union, and had done all in his power to promote its interests. As a secretarial colleague to Mr. Lawson Tait they wanted a gentleman with enthusiasm tempered with a wise discretion, and he believed that in Dr. Wilson they had such a person, and that he would prove a most valuable secretary.

The resolution was unanimously carried, and Dr. Wilson briefly returned thanks, and expressed his willingness to do all he could to promote the welfare of the Union.

On the motion of the Rev. O. M. Feilden, seconded by Mr. Charles Pumphrey, a hearty vote of thanks was passed to the president (Mr. G. H. Claughton), who briefly responded, and the annual meeting closed.

It may be added that the *locale* of next year's annual meeting was discussed, but it was decided to leave the matter in the hands of the Executive Council. It had been arranged that following the annual meeting the party should be conveyed to Oakham for the purpose of visiting Cox's Rough quarry, and of hearing a description of the hills by Mr. E. B. Marten, but at the time arranged for the start rain descended in torrents, and, as it continued, this very pleasant trip had to be abandoned.

Early in the evening the annual dinner of the Union took

place at the Dudley Arms Hotel. The attendance by this time had slightly increased. Mr. John Amphlett presided, and he was supported by Mr. Lawson Tait.

THE CONVERSAZIONE.

The attendance on the whole was satisfactory. Amongst the company we noticed Mr. John Amphlett, Mr. Hickey, Mr. Frank Grazebrook and Mrs. Grazebrook, Mr. Lawson Tait, Dr. T. Stacey Wilson, Mr. A. Freer (Stourbridge), Dr. Fraser (Wolverhampton), Professor Lapworth, Mr. Renaud, Mr. E. B. Marten, Mr. W. H. Hughes, Rev. T. Denham Williams, Rev. J. B. Lloyd, Mr. H. Johnson, Mr. F. North, Mr. Wickham King, Mr. W. Madeley, Mr. J. G. Jones, Mr. T. Jones, &c. One of the main features of the interesting collection was the large number of microscopes, with all kinds of specimens. These were largely inspected by the visitors. Fossils were numerous (many of them unique) and perfectly representative of the district, rich as it is in geological flora and fauna. Mr. E. Hollier sent some of his famous collection of trilobites, whilst Mr. H. Johnson and Mr. Wickham King also furnished some rare specimens. Mr. Lawson Tait kindly lent a fine fossilised fish from the beds of the Green River Eocene, the Bear River, Wyoming. The most attractive exhibits to the majority of visitors were, probably, the beautiful models of the South Staffordshire Coalfield belonging to Mr. Marten, the well-known civil engineer. The large one was unique and valuable. Mr. F. North had a very interesting and instructive collection of South African minerals, including a magnificent diamond in the rough. There were also many other curiosities of African life, and splendid photos of the diamond mines at work. Mr. North added to this interesting result of his travels abroad a huge model of a new section of the Natal Coalfield. The conversazione was particularly rich in pictorial exhibits. The walls all round the hall were covered with sections of the South Staffordshire Coalfield, photographs of various mining operations at home and abroad—including Mr. C. Cochrane's splendid photos that were in the last Dudley exhibition; old pictures showing how the great seam of thick coal was worked in olden times, drawings of numerous workings and pit accidents. Mr. H. Evers-Swindell lent some very interesting archæological sketches, principally of Shropshire abbeys and churches. Mr. Frank Evers's cases of butterflies and shells were amongst the most interesting of the exhibits, whilst Mr. Lawson Tait's valuable Japanese curiosities excited much admiration. A rather new thing was introduced—a process

by which impressions of the fingers were taken to be "used in evidence against you," as it were. Mr. T. V. Hodgson took impressions of the fingers, and it appears that the fine lines on the fingers form a ready and infallible means of identification. They are of a definite shape and number, and never alter during life; an impression of a finger will enable its owner to be identified at any future time, however great the interval. Professor F. Galton, F.R.S., is the sponsor for this interesting discovery, and an article in the "Nineteenth Century," in August last, exemplified it to a very interesting extent. The National Telephone Company had a number of instruments in an ante-room, and visitors were able to hear music which was being performed at the Savoy Theatre, London, and other places at a distance. During the evening Dr. Lapworth, F.R.S., delivered a most interesting lecture on local geology, of which we hope to give a *resumé* in a future number. Mr. W. Madeley also gave an address on "Crinoids," of which there is a very fine collection in the Dudley Society's Museum.

WEDNESDAY, OCTOBER 14TH.

Tuesday night was one of the stormiest and most rainy of the season; but between six and seven on Wednesday morning the clouds dispersed, and there then seemed to be a prospect of improvement in the weather. It was just a little too bright, however, and about nine o'clock the rain was as heavy and the wind as boisterous as at any time during the previous twenty-four hours. It had, however, cleared again when the members of the Union assembled in the Courtyard of Dudley Castle to begin the proceedings of the day by the inspection of the stately ruins. The number as compared with the previous day was very much increased, and reached the figure of seventy or eighty. Mr. G. H. Claughton and Mr. E. B. Marten pointed out the most interesting features of the Castle ruins. The Keep was thrown open, and many ascended to the top, which commands a view not easily equalled in the Midlands. Unfortunately black clouds were being driven up before a south-west wind, and a leaden and tempestuous looking sky lowered over many of the most interesting points in the varied scene. From the Castle the party proceeded to the caverns underneath the hill, pausing for a moment at the great landslip about midway. Here Mr. Wickham King explained for the benefit of strangers, that the pillar left to support workings similar to those they were on their way to visit, had given way and so dropped in the surface, which necessitated the making of the road on

which they stood across the chasm. He also called attention to the inclination of the limestone measures, and to the remnants of the pillar which lay in the great hollow beneath.

THE DUDLEY CAVERNS.

The steep descent to the caverns, whither the party were bound, has been made easy by the construction of a stair of many steps. At the bottom of this the way is still a very steep gradient, and far beneath, through the opening between the supporting pillars, glimpses are obtained of galleries beyond galleries. Lighted candles dotted the rude wall which fenced off the line of route from hollows where either lie "confusedly hurled huge masses of rock," or where, black as Acheron, stagnate the remnants of the old canal. Here and there, on some coign of vantage, candles, grouped on a St. Andrew's cross, illuminated some special spot or feature; but all through the vast vault the light was ample. The road winds considerably, and here and there, through an opening above, rays of sunlight were thrown athwart the path. The descent of another stair, and the ascent of a steep incline a little beyond, brought the party into the great chamber in which the Bishop of Oxford, in 1839, crowned Sir Roderick Murchison "King of Siluria." In an alcove of this chamber shone an illuminated device—the letters V.R., with a star between. Here, in answer to a call, Mr. Claughton said that the caverns were artificial, and had been made in providing a flux for the blast furnaces of South Staffordshire, at a time when there were more of these about than there were now—192 against a remnant of 49 only. The canal passed along the lower part of the workings, and the miners, therefore, had only to drop the limestone they quarried into the boats, which were drawn out and passed into the Birmingham Canal. They would note the angle at which the strata lay, and that the pillars left to support the superincumbent mass were at right angles to it. Pillars sometimes gave way as they saw at the landslip; and these caverns had once extended far beyond the point at which the party now stood. Gradually the extent had been diminished by falls; but they did not intend to be beaten back from that point. The roof was carefully picked over; and it was their hope that the caverns would be kept practically intact for many years to come. The Rev. J. Hodgson, by request, said a few words upon the Silurian limestone, particularly noting the many and beautiful fossils it contained. It had been upheaved as they saw, and this upheaved the carboniferous strata above, as would be shown later on at the Claycroft open workings. He could not conclude without thanking, on behalf of those present,

Mr. Claughton and the Earl of Dudley for the pleasure they had afforded the party by opening and illuminating these caverns. Mr. Claughton briefly replied, saying that he was only doing what the Earl of Dudley himself would have been delighted to do if he had been in the neighbourhood.

While the speaking was going on, a figure could be dimly discerned moving about the innermost recesses of the cavern away behind that heap of "fragments of an earlier world," which constituted the "throne" of the "King of Siluria." "Now, Addenbrooke," said Mr. Claughton, after Mr. Hodgson had finished. "Fire away," shouted Mr. Addenbrooke, and anon the dim figure stood revealed amidst a blaze of coloured light, which threw its reflection on sloping roof and rugged wall. As these coloured lights died down at one point they flamed out at another, and the culmination was reached when the deep hollow against the further side of the opening became suddenly suffused with a rich ruddy glow, kindled by a man hitherto invisible on a raft in the canal. These temporary illuminations over, the party retraced their steps, but stopped at a large opening near the place of exit, to give, on the motion of Mr. John Amphlett, three hearty cheers, as expressive of their good wishes, for the future health and happiness of Lord and Lady Dudley. All then sought the open air, highly delighted with their visit to what Professor Lapworth on a recent occasion happily described as "the interior of an old coral reef which stretched eastward as far as St. Petersburg."

THE PRIORY AND WREN'S NEST.

From the caverns the party proceeded to the Priory to inspect the mouldering remnants of what was once an important religious house. Its existence was due to the piety of Gervase Paganel, Lord of Dudley, who founded it in order to give effect to an intention of his father, which the intervention of death prevented his carrying into effect. The foundation dates from the year 1161; and it was an appanage of the greater monastery of St. Milburga of Wenlock. A Bull of Pope Lucius III., confirming the monks in their possessions and privileges, is in the muniment room at Himley. The Priory was dissolved in 1540, and so put an end to the provision in a deed, dated 1470, which the Rev. J. Hodgson stated he had seen, in which one Thomas Hodgetts provided an endowment to keep a candle burning *for ever* before the altar in the church. "There have been many showers since then," Mr. Hodgson remarked, "and I'm afraid the candle has gone out." At the beginning of the century the ruins were much more extensive than they

are now. An engraving of 1821 shows an octagonal tower, which has since disappeared, indeed a considerable portion of the building was taken down many years ago for the convenience of a manufactory, into which the tenantable remains were converted, and many now alive remember the fender works of Messrs. Marsh, of Burnt Tree, occupying this ground. The chain of fish ponds kept and preserved by the monks, as was common in olden time, can still be discerned.

From this point brakes were provided to convey the party to the Wren's Nest. The programme supplied for the party very succinctly described the characteristics of this remarkable eminence. Its form is that of an elliptical dome, and the strata which compose and bind it round, rise on the east side at an angle of sixty degrees, and on the west side of forty-five degrees; the limestone lies in two beds, the upper, called grey or crystalline, about eight yards in thickness, used as a flux in the blast furnaces of the district, and the lower, known to the miners and those engaged in working it, as blue, about thirteen yards in thickness, used for converting into lime, for building and agricultural purposes, and which is separated from the upper bed by strata of limestone shale, about thirty-three yards in thickness. Ingress is gained to the galleries—tiers of which run from end to end on either side—at the north and south ends where the workings extend to the surface, and on the west side by pits seventy-two yards in depth, the bottom of which is level with the wharves on either side of a canal basin, where the limestone won in the several galleries is loaded into boats for conveyance through a tunnel about two-thirds of a mile in length driven through the centre of the hill, and showing the double stratification in its entirety. The canal joins the Birmingham system at its outlet at Castle Mill. The earliest reliable information of the quarrying of the limestone is that it was quarried in the outcrop and calcined into lime in kilns, placed for convenience as near as possible to the point quarried; traces of these kilns being visible in several places on the sides of the Hill. According to rumour, the coal required in the process was conveyed by means of panniers on horses' backs. Refreshments were provided in that portion known as the Daylight Cavern, by the kindness of the Earl of Dudley.

THE OPEN COAL WORKS.

The open coal works at Foxyards were afterwards seen. The site of this work occurs at the north end of the glen, stretching away beyond the Castle and the Wren's Nest Hill, the whole of which ground is in a disturbed and tangled condition as regards its strata,

and the saddle shape of the coal here bared shows the abrupt effect of the subterranean expansion produced upon the upheaval of the limestone ridges, in a somewhat different manner to that shown near the Netherton Hills upon the other side of the town of Dudley. Upon the west side of the limestone ridges the cropping out of the coal measures may be observed following a long and much more easily defined line. The violence of the obtrusion of the huge dome of limestone was probably unaccompanied by high temperature in the measures immediately subjacent to the surface, for the coal here is very hard and good, and of an average thickness of eleven yards. The Claycroft open works were here seen, where the thick coal, thirty-five feet thick, was being quarried, and the full section was open to the surface. From there the party proceeded to Sedgley Beacon, close to which is the Western Boundary Fault of the South Staffordshire coalfield, which was described by Mr. Henry Johnson, M.E., Dudley, in the programme supplied to the party, as follows:—Up to the present time only one attempt has been made, by sinking, to prove the nature of the strata beyond the fault, whilst the result of numerous lateral explorations from the parent coalfield indicate that it is a clean cut off fault of varying extent, but probably not more extensive than the so-called Boundary Fault, which brings in the Permians at a point directly opposite on the eastern side of the coalfield. The Eastern Boundary or “Symon” Fault of the Shropshire coalfield, which, until quite recently was known only as a slightly inclined ledge of denuded coal measures, led many to the opinion that the Western Boundary Fault of the South Staffordshire coalfield was a highly inclined cliff of coal measures, also the result of denudation, and that the intervening space was once the site of an estuary, the waters of which had carried away the coal-bearing strata, and which had become filled up by a subsequent deposition of Triassic and Permian strata. This opinion has, however, quite recently received a complete negative, for the “Symon” Fault has proved to be only a “wash-out” of comparatively limited extent, the coal measures and coals existing intact in the direction of South Staffordshire.

This concluded the tour, and votes of thanks were accorded to the Earl of Dudley and Mr. G. H. Cloughton for their kindness to the party. On the return to Dudley the party partook of tea *à la fourchette* at the Saracen’s Head Hotel, after which they dispersed.

Fortunately the party were under shelter during the

occasional heavy showers of rain, and, notwithstanding all drawbacks, there was no lack of hearty enjoyment. The arrangements made were excellent, and the local organising secretary, Mr. Wickham King, seems to have left nothing unforeseen or unprovided for.

BURMA AND ITS PEOPLE.

BY A. W. WILLS.

(Concluded from page 233.)

Of Mandalay itself it is difficult to give any adequate idea in the short space of time remaining to me. Anything like a full description of its wonders would occupy hours instead of the few minutes which are left.

A battlemented wall, some twenty feet high, encloses a space a mile and a quarter square, within which were gathered, in King Theebaw's time, some 90,000 people, the palaces of the king and of his queens, ministers and officials, being in the centre. This mass of buildings and the gardens and artificial lakes of the palace grounds were further surrounded by a high palisade of huge teak logs, while the outer walls were defended by an enormously broad moat, the waters of which are now covered with pink and white lilies.

When the city was captured in 1886 its only scavengers were herds of black pigs, which exercised their functions even within the precincts of the royal palaces; and, for sanitary and military reasons alike, it was found necessary to clear out the entire native population assembled within the walls.

This sounds like a high-handed and somewhat unmerciful proceeding; but it was an absolute necessity and inflicted, moreover, no real hardship. There were no vested rights of tied houses, or otherwise, to be considered; every householder received fair compensation; there was unlimited room among the tamarind and pipul trees outside, and the city was simply and easily transferred to a new quarter. It must be remembered that a Burman builds a new house in three or four days. After consulting an astrologer as to the choice of a lucky day, he begins the work, taking care that one or two of his bamboo posts are left higher than the rest, and that no window opens immediately behind these, so that any evil spirit that happens to be passing may alight outside, and not be tempted to enter the dwelling; and these important details being settled, the rest of the house is run up in a few

days. The bamboo from the jungle affords all the materials that are needed—uprights, wall-plates, roofs and even floors.

The Burmese are great believers in spirits and have a firm belief that every passing breeze is laden with invisible powers of good or evil. In remoter parts of the country, where English influence and example have not yet penetrated, lamps are hung among the trees at night to entice evil spirits away from the village; and where contagious disease prevails coloured threads or lattices of bamboo are hung across the paths to intercept the demons who might carry the malady from one hamlet to another.

Of the once great city within the walls of Mandalay nothing remains but the palaces of Theebaw and his court, huge masses of teak structures of strange and fantastic architecture, rich with gold and vermilion and profusely decorated with a kind of inlaid work in which small pieces of silvered glass play a prominent part, often rude in design and coarse in execution, but withal producing a general impression of barbaric splendour.

The queen's palace is now used as the English club, while many of the suites of buildings which were once the abode of the king's wives and ministers are now occupied as public offices and barracks.

The king's and queen's throne rooms are intact, and so is the great carved doorway through which Theebaw was once accustomed to appear in public audience; but the lofty and handsome hall in front of and below this door, in which princes, ministers, and suitors were wont to grovel before the "golden feet" with foreheads touching the ground, has, with singularly bad taste, been converted into the church of the garrison, whose quarters, with the bungalows of the English officials and residents, are scattered over the now park-like expanse where the ancient royal city of Mandalay once stood.

On the door of an adjacent chamber we saw the red finger marks which form a bloody record of summary vengeance inflicted by Theebaw's queen on one of the court ladies, whom she suspected of bestowing too tender a glance upon her amiable mate. We wandered among the palm groves and beside the artificial waters of the beautiful palace grounds and gathered ferns and selaginellas in the summer house in which the late king capitulated to our general, disdaining, with a pride which one cannot help admiring, to perform the act of abdication within the walls where he had reigned in undisputed supremacy. These and many other striking things we saw in Mandalay.

But the glory of the place is in its ecclesiastical architecture, if I may use the word. Time fails me to describe the "Incomparable Pagoda," or the "Four hundred and fifty-one Pagodas," where, grouped round a central shrine, are four hundred and fifty lesser ones, each containing a large upright slab of stone, on which is engraved a passage from the Buddhist sacred books; or of the marvellously interesting "Araccan Pagoda," with its great gilt bronze Gautama, its innumerable votive offerings, its paintings of the Buddhist hells, beside the realism of which the horrors of Dante's word painting seem feeble; and, above all, the amazing multitude of worshippers—people of a dozen different tribes and races, who all day throng its approaches or kneel before its shrine.

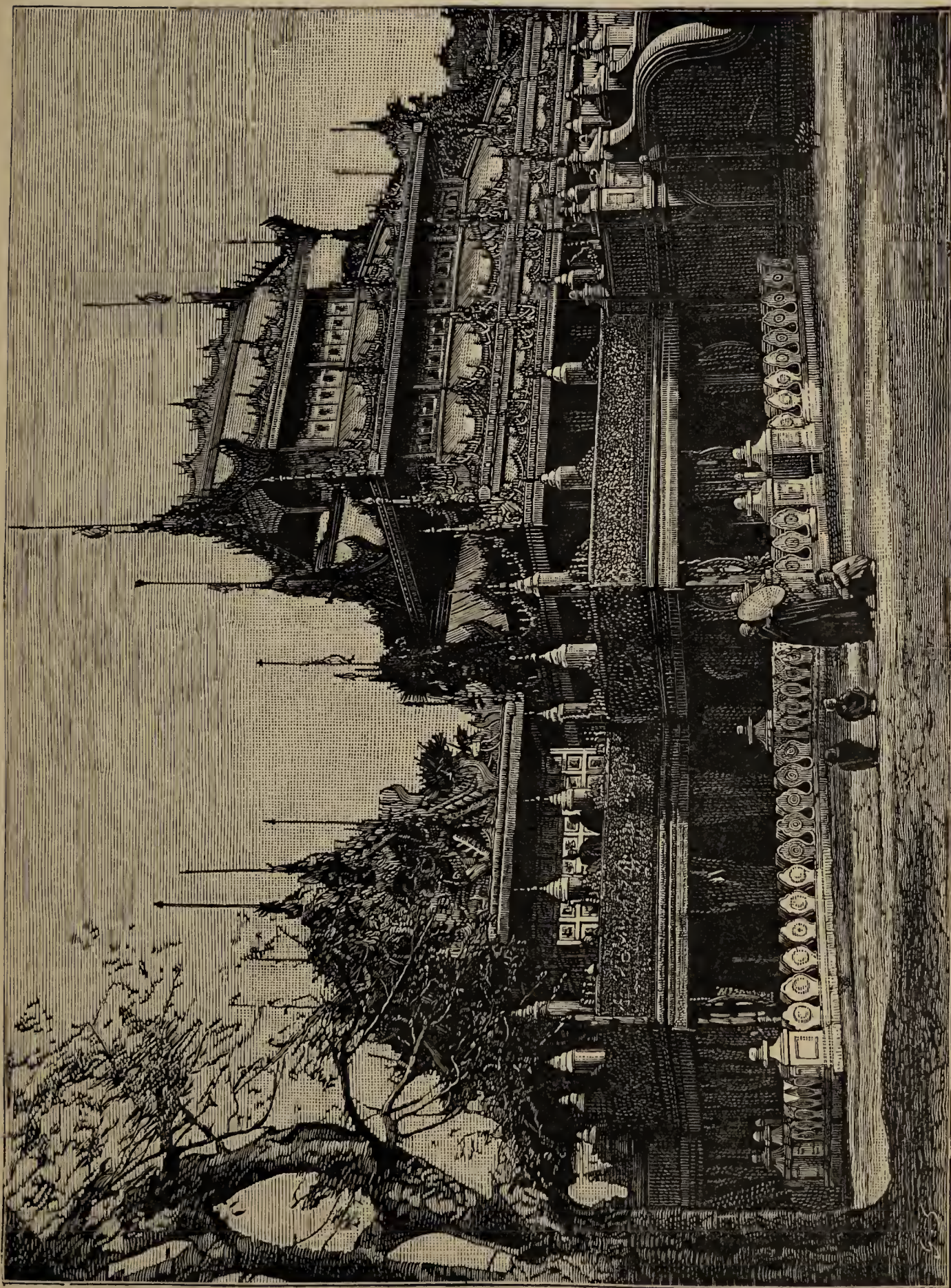
No less wonderful and of paramount beauty are the almost innumerable Kyoungs, of which two, the "Golden" and the "Queen's," stand foremost in excellence of design and elaborate daintiness of workmanship. The Queen's Kyoung is shown in Plate 13.

It is, fortunately, unnecessary for me to attempt the difficult task of describing buildings which admit of no comparison with anything of European origin, because the photographs which I was able to secure speak for themselves. I need only say that, with the exception of the steps by which they are approached, they are built wholly of teak wood, that there is scarcely a square foot of their surfaces which is not enriched with truly admirable carving and that from floor to topmost pinnacle they are covered with pure gold leaf.

You may well imagine that their gilded corridors, their many-tiered roofs, fantastic spires and lofty pinnacles, rich with tracery and fretwork, glisten against the cloudless tropical sky with dazzling effect.

One word about their inmates, the Hpoongyees. Whenever we visited these buildings we were received with that graceful courtesy which seems inborn in the Burman of high or low degree. The Buddhist brethren themselves showed us every part of their establishments: their chapels, with the sacred images of their master and the accessories of their services; their dormitories and their libraries, in which some of their number were generally engaged in transcribing portions of the sacred literature in delicate characters on to prepared palm leaves, which are afterwards tied together into books.

Remembering that the Pagoda and the Kyoung are alike sacred places in the eyes of the Buddhist, it is but simple courtesy in the English visitor to pay the same outward



THE QUEEN'S KYOUNG, MANDALAY.

tokens of respect when he enters them as he would expect from a stranger from some far-off land who entered one of our own Christian churches ; and it is a courtesy fully understood and appreciated in this land, whose inhabitants seem to be Nature's gentlefolk.

Wherever we went we were received with easy grace, and whenever we left we conformed to the custom of the country by asking permission to depart, and invariably heard in reply the simple and courteous words, " You may go ; come again."

But I must conclude lest you invert this phrase and say, " Go, but do *not* come again."

I trust that I have given you some slight idea of this distant land and its pleasing people ; a land where extreme contrasts of riches and poverty are scarcely seen, where Nature is glorious, and where a religion, venerable in its antiquity, can still be studied in almost uncorrupted simplicity ; a land, too, of abundant promise, for everywhere outrage and dacoity (that form of crime of which we at home hear more than those on the spot) have disappeared or are disappearing before a just administration of the law ; intercourse between distant regions is advancing by leaps and bounds ; everywhere the people sow their crops, garner their harvests, and ply their handicrafts in peace and security.

I regard it as the fairest jewel in the crown of the Empress of India, and believe that it is destined to grow yet fairer and richer, unless we have parted with the energy and resolution which have characterised our race in the past.

NOTE ON SOME ORES FROM THE BARRIER RANGES, NEW SOUTH WALES.*

BY T. H. WALLER, B.A., B.SC.

The most casual reader of the Australian papers cannot fail to remark that our colonial brothers are very much in earnest in two directions, business and pleasure, especially in

* Read before the Birmingham Natural History and Microscopical Society, February 18th, 1890.

the respective forms of mining and horse-racing. It may be that the excitement of the former is found to be closely allied to that of the latter, for, of all uncertain speculations, I am informed that mines and mining shares need fear comparison with but few. Still, mines require machinery, and in the course of a visit to the celebrated silver district of Silverton, in the Barrier Ranges, on such business, my brother procured for me a few specimens of ores and rocks, on which I propose to make some remarks this evening. As probably the locality is not familiar to most Englishmen, seeing that it is not more than six or seven years since the mineral wealth of the district brought it prominently into notice, I may be permitted to give a few particulars as to the whereabouts of the mines.

They lie on the extreme western boundary of the Colony of New South Wales, in lat. 32° S., and long. $141\frac{1}{2}^{\circ}$ E., about 600 miles very slightly N. of W. from Sydney, and about 300 N.E. of Adelaide, and it is strikingly illustrative of the difficulties of land communication that the way to get to the district from Sydney, is through Adelaide. Just as the Riverina country has its natural outlet towards Victoria, so the Barrier Ranges have their chief traffic with South Australia. It was, at the time of my brother's visit, no light undertaking to get there, even from Adelaide. One hundred and forty miles of railway travelling, which can, I am told, be a very uncomfortable experience in a South Australian summer, had to be supplemented by about 200 miles of coach; and, seeing that these roads have all the heavy traffic to and from the mines passing over them, we may be quite sure that they are not as comfortable to travel over as, say, the wood pavement of New Street. It is, however, somewhat better off now, as there is railway communication with Port Adelaide and Port Pirie, which, of course, much reduces the expense of sending away the ores.

When you arrive, you find that the country is unmistakably meant for a real desert. The water supply is of the scantiest. At the time of my brother's visit the precious fluid was selling at so much per gallon, and, although I cannot remember the exact figure, I have the recollection that a wash would cost the greater part of a shilling. The quality is inferior, as the article supplied has about the colour, and nearly the consistency, of pea-soup. Add to this the fact that the thermometer stands, on occasions, at 120° in the shade, and no one will be inclined to wonder that much of the business of the place is done at night, when the temperature falls very considerably

on account of the great dryness of the air. The want of water is a very serious drawback to the mining operations. As is well known, ores are usually sorted by a species of washing, the lighter quartzose material being carried further than the heavier ores by a slight stream. Steam engines, again, require water, so that, even with the presence of very rich silver ores, mining in the Barrier Ranges is not entirely unalloyed enjoyment.

The author of a paper on the opal-bearing rocks of S.W. Queensland, some 150 miles north of this district, but in about the same longitude, says, that in 1881, at the time of his visit, there had been no rain for twenty-two months, and that there was then no sign of a change. It was just in the region where Burke and Wills and their exploring party perished. He says that the river systems dry up in the droughts to lines of waterholes, called Billabongs, and proceeds, "Sometimes twenty-five miles separate the waterholes; in some of these a liquid is seen resembling in colour and consistency thin white paint, and this decoction is imposed on strangers as water. It tastes strongly of *cow*."

A series of borings for water has been made between Silvertown and Wilcannia, a town on the Darling, 115 miles distant, but they were reported to be useful only for stock purposes. The report for 1884 of the Department of Mines of New South Wales says that "the permanence, even the very existence, of this field entirely depends upon an adequate supply of water for domestic purposes being provided at all the mining centres," and goes on to suggest the formation of large tanks.

In the report for 1887, it is mentioned that rains had filled the tank, which had just been finished; but that for 1888 gives $3\frac{1}{2}$ inches as the total rainfall for the year, of which two inches fell early in February. However, in the beginning of 1889, two more inches had fallen, so that the works which had been stopped had got to work again.

I have been unable to get any continuous statistics of the production; and the fact that much of the ore has been exported as such adds to the difficulty of presenting the figures in an instructive manner. In 1885 the value of refined silver, silver-lead, and ore sent away from the mines was £108,281. In 1888, silver lead to the value of £863,467, and silver ore to £136,800, was despatched, making a total of £1,000,267, with an additional £1,000 worth of tin ore, £304

of copper ore, and £182 of gold quartz, making a total of £1,001,848.

This must have been very largely increased in 1889, for the returns in the Sydney papers for the last three weeks of the year amount to £48,293, £47,353, and £38,295 respectively. By the way, the weather is spoken of on December 14th as very warm, the thermometer registering 104° to 108° in the shade.

To appreciate the place of these hills in the physiography of Australia, we may remember that the eastern coast of the continent is bordered at a distance varying from forty or fifty to 120 miles by an almost continuous chain of mountains principally composed of granite and allied rocks, which culminates in the extreme south of New South Wales in Mount Kosciusko, the highest summit known in Australia. The granite is pierced with many dykes and sheets of basalt, and the whole of these ranges are highly metalliferous. In Queensland we have Charters Towers in the north, Gympie in the south, and many others. In New South Wales the Bathurst Gold-field, and many others. Diamonds and other gems also occur in fairly considerable quantity, but the difficulties of the country prevent them having, at present, much commercial value.

Beyond these ranges we have plateaux and downs in the north, bounded on the west by another midrib of hill ranges which runs southward from the Gulf of Carpentaria for about 250 miles, and there branches off to the east, giving off again ranges which run south, forming the subordinate watersheds of the borders of Queensland and New South Wales. South of these are the great rivers the Darling and the Murray, with their affluents, which together drain all the colony of New South Wales west of the Coast Range, and form a river system of first-class magnitude. The Barrier Ranges are the furthest south and west extensions of the watershed ranges mentioned above.

The rocks are mostly mica schists, clay slates, and sandstones, with numerous quartz reefs and intrusive masses and dykes of coarse-grained granite and diorite. Nearly all the lodes are in the mica schist, and have been proved over a district seventy miles long by thirty wide. They are very inconstant in thickness and extent: a surface plan resembles the cracks in a dried piece of cross-grained wood, and probably their origin is the shrinkage caused by the intrusion of the crystalline rocks. Some of the lodes appear to be in joints

of the rock. In one mine—the “Umberumberka Silver-lead Mine”—the lode is described as a true fissure vein, cutting the “bedding” of the schists, the ore not seeming to be more plentiful where cutting any particular variety. The ore is worked on the upper or hanging wall of the lode, and varies from a few inches to ten feet in thickness; it consists of a considerable variety of lead minerals—sulphide, carbonate, sulphate—with occasional specimens of chloride of silver and the native metal.

Another mine, “The Broken Hill Proprietary Company,” raises chloride, bromide, and iodide of silver, with carbonate of lead, all highly ferruginous. Indeed, this appears a regular silicious sinter, with much iron and smaller quantities of the precious metal. Some of the specimens exhibited in London in 1886 assayed up to 1,460 ounces of silver per ton. This has a very large look, which we scarcely recognise in the shape of $3\frac{1}{2}$ per cent. of the ore of iodide of silver and $3\frac{3}{4}$ of chloride.

The Barrier Ranges Silver Mining Association showed a specimen of “Oxide of iron in mica schist, with chloride of silver from the Apollyon Silver Mine,” assaying 2,286 ounces of silver per ton of ore. The ore was here about 2 feet thick in a 3 feet lode.

Occasional masses may of course be much richer, the chloride and bromide of silver being present in masses of considerable size. These masses are called slugs, and may be almost pure chloride of silver: two analyses gave respectively (Mining Reports and Professor Liversedge on the Minerals of New South Wales) 72.23 and 81.67 per cent., the latter also containing 10.19 per cent. of bromide of silver. Many of the ores also contain a very minute quantity of gold.

It is interesting to note that the same group of minerals recurs in some of the very rich mining districts of the United States.

Galena is, of course, very widely distributed, but the association with cerussite is characteristic of the wonderful Leadville (Colorado) Mines, where “carbonates,” either hard or soft, are the most coveted ores. These frequently occur in the carbonate, the sulphate, and phosphate, but not in conspicuous quantities. As far as I have been able to test (by the blow-pipe) the specimen of cerussite which I have on the table, there is not much silver contained in it, but no doubt this varies from place to place. Liversedge mentions

a specimen 56.96 of carbonate of lead and 0.3 of iodide of silver. Carbonate Camp, in Lawrence County, Dakota, takes its name from the same mineral, and it is found in Idaho and Montana.

The chloride of silver (horn silver) is a soft, very easily fusible substance, which occurs mixed in very varying proportions with chloride of lead in many of the American mines, notably (and in this case it is almost pure chloride of silver) in the great Comstock Lode in Nevada, two of the mines on which were in 1875 and 1876 each paying dividends of 200,000 dollars a month, fully accounting for the great Bonanza Kings of the States.

At Leadville it occurs in small quantities, impregnating a rhyolitic rock, and it is in this locality that the most searching investigations have been made as to the origin of the precious ore. Very accurate analysis has shown that the minerals of the rock, where it is unaltered, contain minute quantities of silver; this is notably the case with the augite. It is further found that in the neighbourhood of the lodes the rock is much decomposed and has lost its silver, and the conclusion is arrived at that this has gone to fill up the fissure, and so form the mass of ore.

At Leadville also occurs the embolite or chlorobromide of silver and chiefly in a silicious iron ore in cavities and on fissure planes. Now the chlorobromide of silver from Broken Hills occurs in just the same conjunction, as you may see from the specimens before you, and its presence in a mass of kaolin, from which it is easily separated by washing, is a proof of much rock change in its vicinity.

The galena from the Pinnacles Tribute Silver Mining Company gave but a very small bead of silver in a blow-pipe test; but there, again, mine may be a sample of one of the poorer parts of the lode, as I see that the average lode stuff exhibited at the Colonial Exhibition assayed 78oz. per ton.

In one or two of the specimens there are clear indications of copper, and small quantities were evident in the course of the blow-pipe testing.

In 1886 smelting works were erected, and it is simply a question of the cost of fuel whether it will pay to reduce the ores at the mines. The fuel required is coke, and although I have no knowledge of the price of this at Silverton, I find

that it costs £4 per ton at Mitchell's Creek, in the Bathurst district, some 100 miles W.N.W. from Sydney over the Blue Mountains, and it would not be likely to be less in price so much further inland. As it requires about one ton to reduce five of ore, the cost becomes considerable. Limestone is used as a flux, which forms a fusible slag with the silica, iron oxide and alumina. This important material has just (December, 1889) been found at a distance of about thirty-six miles from Broken Hill. The chlorides, bromides, &c., of silver require a proportion of lead ores, such as the carbonate, to be mixed with them, so that the ores in the district are mutually useful.

The rock specimens are simply such as my brother picked up at Silverton, and do not, therefore, show anything more than the general character of the rocks. You will notice that they are schists, gneisses, and granite.

Although these are the richest of the New South Wales Silver and Silver Lead Mines, they are by no means the only ones, and we may probably reckon that the others together afford about an equal value of ore. Thus this one colony is adding its quota, and that by no means a despicable one, to the enormous output of silver which has so reduced the price of late years, to the advantage of the photographer and the very serious disadvantage of those whose incomes depend on the value of the Indian silver rupee.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GENERAL MEETING. September 29th. Mr. T. E. Bolton exhibited a rotifer, *Asplanchnopus myrmeles*, from Castlemorton Common, near Malvern, which was found first at Dundee in 1886 by Mr. John Hood. Mr. W. B. Grove, M.A., exhibited a collection of fungi obtained in the Kingswood excursion on the previous Saturday, including *Russula integra*, *Russula drimeia* (very rare), *Peziza aurantia*, *Polyporus dryadeus*, and *P. fumosus*. Also, on behalf of Miss Hall, the laburnum in leaf, flower, and fruit at the same time, from St. Leonards, and *Linaria vulgaris*, on behalf of Miss McGuire, from the same place (sent per Mr. Hughes). Mr. Martineau gave a report of the Kingswood excursion, and said fourteen attended, and that *Leptodora* was found in the canal. Mr. C. Pumphrey gave an interesting account of a visit he had recently made to the Giant's Causeway, on the coast of Antrim, and exhibited a very fine specimen of zeolite crystals from a cavity in basalt from that neighbourhood.—MICROSCOPICAL SECTION. October 6th. The President, Mr. C.

Pumphrey, in the chair. Exhibition of specimens representing the various sections of the society. On behalf of the Microscopical Section, Mr. T. E. Bolton exhibited *Melicerta tyro*, *Lacinularia socialis*, and a new rotifer, *Asplanchna*. Mr. T. V. Hodgson exhibited *Cristatella mucedo* and *Anabæna flos-aquæ*, both from Barnt Green. On behalf of the Biological Section, Mr. W. B. Grove exhibited and explained the structure of *Peziza vesiculosa*; for Miss Gingell, of Minchinhampton, *Agaricus melleus*, *Marasmius peronatus*, and *Helvella crispa*. A series of insects were exhibited, chiefly relating to the mosquitoes and fairy flies. Also a series of slides showing the structure of the more important groups of plants. On behalf of the Geological Section, Mr. C. Pumphrey exhibited crystals of zeolite from the Giant's Causeway, and there were also exhibited a series of slides showing the crystalline structure of the principal metamorphic rocks. — GEOLOGICAL SECTION. October 20th. Mr. T. H. Waller in the chair. Mr. Grove exhibited *Clavaria condensata*, a very rare fungus, from Hambledon, Hampshire. Mr. Wilkinson exhibited *Hepialus sylvinus*, *Miana uderosa*, *Acidalia scutularia* and other common lepidoptera, etc., from Cromer. Mr. Spicer, a live skua, picked up exhausted in Icknield Port Road. Mr. Chas. Pumphrey, zeolites from basalt of Antrim. Mr. Udal, hon. sec. of the section, on behalf of Mr. W. R. Hughes, read a paper on the "Severn Bore." The paper gave much pleasure to the members and a cordial vote of thanks to Mr. Hughes was carried. The members expressed their regret that Mr. Hughes was unable to be present on account of another engagement. Mr. T. H. Waller exhibited and described several beautiful sections of Obsidian, for which he received the hearty thanks of the section.

BIRMINGHAM MICROSCOPISTS AND NATURALISTS' UNION.—September 21st. Mr. Deakin exhibited specimens of bog asphodel, *Narthecium ossifragum*; Mr. J. W. Neville, a series of very beautiful slides prepared by Mr. A. Flatters, comprising sections of flower and leaf buds, showing all parts *in situ*, and deservedly admired; Mr. Linton, shells of *Pholas candidus* from the wood of a submerged forest, near Tenby; Mr. Hawkes, under the microscope, *Sporendonema muscæ* (fly fungus), also *Achlya prolifera*, its aquatic form; Mr. J. Moore, gizzard of beetle, *Ocypus olens*; Mr. Parker, *Carchesium polypinum*.—September 28th. SPECIAL—GEOLOGY. Mr. P. T. Deakin exhibited a number of named varieties of *Pleurotoma* from the Eocene formation; Mr. G. H. Corbett, a collection of named minerals, fossils from the coal measures, sections of fossil corals, and various rocks, one showing Oolitic structure in carboniferous limestone, and a collection of fossils from Westbury-on-Severn, also a series of photographs of the rocks of the latter place; Mr. H. Hawkes, a large collection of fungi from Sutton Park, with remarks on their edible and non-edible qualities, and a series of white moulds shown under the microscope, their structure being illustrated by that of *Erysiphe communis*; Mr. W. J. Parker, the swan-necked animalcule, *Trachelius ovum*.—October 5th. Mr. G. H. Corbett exhibited a slab of Wenlock limestone with remarkable clusters of *Rhynchonella Wilsonii* from Linley caverns; Mr. J. Collins, a collection of dried plants from the Arley district; Mr. Linton, eggs from nest of house sparrow, showing considerable variation in colour; Mr. Parker, under the microscope, a rotifer, *Salpinx redunca*.—October 12th. Mr. J. Madison gave a lantern exhibition of "Natural History

Objects." It comprised a series of photographs, all bearing on natural history, and included most interesting pictures of rural scenery, mostly local, though some were taken in Dovedale and the Cheltenham district; a maple covered with mistletoe, and old oaks in Packington Park, birds, flowers, fruits, ferns, grasses, hoar-frost effects, shells and other objects.

BIRMINGHAM ENTOMOLOGICAL SOCIETY.—September 21st, 1891. Mr. R. C. Bradley in the chair. Mr. P. W. Abbott showed *Tæniocampa opima* and *gracilis*, and *Nyssia zonaria* from Wallasey; also *Argynnis paphia* v. *valesina* from the New Forest. Mr. G. W. Wynn showed *Sesia culiciformis* from Wyre Forest. Mr. W. Harrison showed a bred series of *Selidosema ericetaria* from the New Forest. Mr. R. C. Bradley showed four specimens of *Pteropœcilia lamed* from Sutton, which he said Mr. Verrall had confirmed. Mr. C. J. Wainwright showed *Plusia orichalcea* and *Arctophila mussitans* from North Cornwall. Mr. W. Harrison showed a box of beautifully preserved larvæ. He had managed to retain the green colours in *Saturnia carpini* and others by inflating them and allowing them to dry naturally, without heat, which takes only about twenty minutes.—October 5th, 1891. Mr. W. G. Blatch, president, in the chair. Mr. R. C. Bradley showed a long series of *Spilographa Zoe* from Moseley. This species is usually found singly, but Mr. Bradley succeeded in taking it freely from the undersides of leaves at Moseley. Mr. G. W. Wynn showed a box full of large American Bombyces; also *Xylophasia hepatica*, which he had bred from pupæ found underneath the bark of poplars at Cleeve Prior. They were in cocoons and situations which exactly resembled those of *Acronycta megacephala*. Mr. W. Harrison showed *Papilio machaon* from Wicken. Mr. W. G. Blatch showed the following beetles:—*Ilybius aenescens* from Tysoe, Warwickshire; *Homalota crassicornis* from Bewdley; *Oxytelus fulvipes*, *Henoticus serratus* (a series), *Micropeplus tessera* (a series), and *Lampronia luzella*, all from Knowle.

OXFORD NATURAL HISTORY SOCIETY.—October 22nd.—The first meeting of the session was held in the Geological Lecture Room, when Professor A. H. Green read a paper on "The Malverns and their Surroundings." He described the splendid view obtained of the Malverns on approaching them by rail, especially when nearing Worcester. Looking at them from a distance, an idea of their height is gained; standing out as they do from the surrounding flat country, the peaks look almost mountainous. The hills are composed of hard rock, crystalline schist, and are probably very old indeed. In the plain eastward are found soft rock, lias. On climbing Bredon Hill, and looking eastward, a lovely view of gentle undulating country is obtained: the vale of the Severn, with its charm of beautiful timber and hedges, and, beyond that, the Cotswolds, which, like the high hills of the Malverns eastward, are capped with Oolite, and are a very good illustration of denudation. Towards Ledbury, looking west, quite another view is obtained of charming country; the hills there are Silurian, and the May Hill beds are sandstone. The sand is coarse, and in some places almost shingle. As Ledbury is neared, the Silurian rocks end, and the red shale, which stretches nearly all over Wales, commences. Near May Hill is seen the Oolite of the colliery of Dean, and of Dean Forest.

PROFESSOR LAPWORTH, F.R.S.

Midland geologists, and indeed a far wider circle than they comprise, will read with intense gratification the announcement that one of the two Royal Medals annually at the disposal of the Royal Society has been awarded to Dr. Charles Lapworth, the accomplished and genial Professor of Geology in the Mason College, Birmingham; and that Her Majesty the Queen has been pleased to approve the award. As an enthusiastic field worker, Professor Lapworth has gathered around him, since he came to the Midland district, a large circle of devoted students, and to these, who have not merely learned of him how to work, but have been privileged to obtain an insight into the kindly nature of the man, the news that one of the highest honours the Royal Society annually bestows has fallen to the lot of their leader and friend will especially arouse the liveliest feelings of pleasure and pride; while that far larger number who have a keen interest in the repute of the Midland metropolis will feel an equal degree of pride at the high honour which has fallen to her great scientific college in the person of one of its most popular professors.

Some few words as to the history of the Royal Medal may not be out of place in the pages of the "Midland Naturalist."

It was founded in 1826. The first scientist to whom it was given was John Dalton, the founder of the Atomic Theory of Chemistry. Among others to whom it has since been awarded we may instance Sir Humphrey Davy, Faraday, Herschel, Owen, Lyell, Huxley, Darwin, and Sir William Thompson. Within the last ten years it has been granted to Professor Flower, Lord Rayleigh, Professor Ray Lankester, Professor Moseley, Professor Thorpe, and on the present occasion to Professor Rücker and Professor Lapworth.

The Royal Medal does not appear to be very frequently awarded to geologists. The only British geologists who have hitherto received it are Sir Chas. Lyell, Dr. Mantell, Professor Prestwich, Henry Sorby, and Professor Andrew Ramsay. Sir Andrew Ramsay—who was then the head of the British Geological Survey—secured the medal in 1879, and this was the last award to any British geologist.

Professor Lapworth's geological investigations have been as a rule among the oldest and most complicated of the British rock-formations, and principally among those which used to be called the Silurian of Sir Roderick Murchison, and he has published more than thirty original papers, giving accounts of his discoveries and his conclusions.

His first geological labours resulted in his discovery of the

key to the natural arrangement of the rocks of the Southern Uplands of Scotland, and his conclusions were published in his lengthy papers of the "Moffat Series," the "Girvan Successions," "Ballantrae Rocks," &c. Although his general conclusions were very different from those previously held, and were not received for many years by all parties, they now appear to be universally accepted.

In the most complicated and puzzling country of the North-west Highlands, his accounts of the facts, and his theories of their interpretation, as given in his papers on the "Secret of the Highlands, &c.," were at first very heretical and unpopular, but as similar ideas were independently arrived at by the officers of the Geological Survey, they have nowadays found their way into our geological text books, and mark an accepted stage in the development of the study of the geology of that extraordinarily difficult region.

The important family of fossils known as the Graptolites used formerly to be almost wholly neglected in working out the ancient rock-formation where they are very abundant and widely distributed. Lapworth shewed, in several papers on the subject, that they could be reduced to order like other groups of the invertebrate animals, and that once properly classified they were of the utmost value for the purposes of the working geologist. His classification of these fossils, and his explanations of their use in geology, will be found employed of late years in the text books and publications dealing with this subject in Britain and abroad.

In the West of England Professor Lapworth has for some years been busied in working out the natural arrangement of the older rocks and fossils of Shropshire and elsewhere, and it appears, from such results as have been already published, that the supposed confusion and complication in that district will also disappear when the facts are out and the maps completed.

In our own district, Midland geologists will recollect how Lapworth and his geological friends and students discovered Cambrian rocks and fossils at Nuneaton and elsewhere, in rocks which used before that time to be considered to be carboniferous. This led to quite a fresh geological interpretation of deeper parts of the underground structure of our neighbourhood; and of late years these discoveries have been confirmed and extended by the Geological Survey, and inserted upon the local geological map.

In 1888, Professor Lapworth discovered a new group of fossils in some of the very oldest of the Shropshire rocks, a whole formation below where fossils of such a highly organised character were previously known to occur in

Britain. This made the greater stir, as similar fossils were detected about the same time in America and Europe.

Dr. Lapworth's work is quite as well known abroad as in England, for his results when published could at once be tested and employed anywhere among the older rocks in any part of the world where they occur; so that the geological literature of other countries for several years past contains abundant allusions to his results and opinions—the former being found generally adopted, the latter being often strenuously attacked and resisted.

Many of the younger geologists in Britain and abroad have enthusiastically worked more or less in company with Professor Lapworth at the unsolved problems of the older rocks and fossils—each in his own sphere—and the results of the common advances made are seen in the fact that several of the old controversies that barred the progress of geological science are fast disappearing.

For instance, the old Highland controversy of about thirty years' standing was practically laughed out of existence when the results quite independently obtained in the North-west of Scotland by Lapworth and by the officers of the Survey proved to be almost identical, shewing that both of the old contending parties were right, and both were wrong. On the Continent of Europe an equally exasperating controversy on what was called the Theory of Colonies had smouldered for years; but almost immediately English and foreign geologists employed Lapworth's facts and results connected with the Graptolites, in studying the question, the old difficulties disappeared, and the controversy has since become practically extinct. In the same way, Dr. Lapworth courageously endeavoured to reconcile the disputants in the famous Sedgwick-Murchison controversy by proposing the title of Ordovician for the old Lower Silurian or Upper Cambrian system in dispute; and, although a few of the older geologists are still reluctant to accept the olive branch, the younger British workers seem all to have adopted the name, and the old controversy is slowly dying a natural death.

Professor Lapworth was appointed to the Mason College in 1881, his candidature being supported by some of the chief geologists of Britain and Europe. He had the honorary degree of LL.D. of Aberdeen conferred upon him in 1884; in 1887 was awarded the Bigsby Gold Medal of the Geological Society of London; in 1888 was elected to the Fellowship of the Royal Society, and is an honorary member of several British and Foreign Geological Societies. He has been examiner in Geology to the University of Cambridge, and holds at the present time the like place in the University of London.

W. H.

SIR RODERICK MURCHISON AS KING OF SILURIA.

Mr. Rabone wishes us to make a correction in the report of the meeting of the Midland Union of Natural History Societies at Dudley, in last month's "Midland Naturalist." The report states that in 1839 the Bishop of Oxford crowned Sir Roderick Murchison King of Siluria in the great cavern of Dudley Castle Hill. Much misapprehension, Mr. Rabone says, now exists about this matter. A newspaper correspondent, in commenting lately upon the circumstance, asked what kind of a crown was used, of what material was it composed, and whether any other regalia were used in the ceremony. The facts were simply these:—At the meeting of the British Association in 1849, Dudley was visited, and Sir Roderick Murchison, in the great cavern of the Castle Hill, briefly explained the system of geological strata to which he had given the name of "Silurian," extending over the Alps, over the Ural Mountains, and, indeed, over the whole Continent of Europe. Afterwards, on adjourning to the Wren's Nest, Sir Roderick further discoursed on the same subject; and, in proposing a vote of thanks to him, the Bishop of Oxford said that although Caractacus was an old king of part of the Silurian region, yet Sir Roderick had extended the Silurian domain almost illimitably, and it was only just and proper that there, upon a Silurian rock, he should be acknowledged the modern king of Siluria. The Bishop, then taking a gigantic speaking-trumpet, which he had brought with him, called upon all present to repeat after him the words which are given below. He then spoke through the trumpet, giving one word at a time, to enable those present to repeat it all together—

Hail—King—of—Siluria.

Then after a pause—

Hail—King—of—Siluria.

And again—

Hail—King—of—Siluria.

The vast assembly thrice responded with stentorian voices and most hearty hurrahs, and ever afterwards Sir Roderick was proud to be acknowledged "King of Siluria." These are the simple facts. In 1839 Dr. Wilberforce was not Bishop of Oxford, nor had Sir Roderick then achieved his full fame for his discoveries. 25,000 persons visited the Dudley Caverns on that day in 1849, though they were not all present at the time the Bishop's call of acknowledgement was made.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

DUDLEY MEETING.

ADDRESS BY PROFESSOR LAPWORTH, F.R.S.

[Our readers must bear in mind that this is only a bare *resumé* of Dr. Lapworth's observations.]

THE GEOLOGY OF THE DUDLEY DISTRICT.

Professor Lapworth, who was received with cheers, said he had been invited to address the Midland Union of Natural History Societies upon the geology of the Dudley district, with especial reference to the Dudley Caverns, which were to be visited the next day. He gathered from this that it was his duty to do his best to give such a brief outline as should make the structure and the fossils of the district clear to those present who came there from a distance—to describe to them the geology of the Dudley district in so far as it was related to the Midlands in general. During the last century Dudley had been fertile in geologists of eminence. Professor Beete Jukes lived and worked in the neighbourhood of Dudley, and his work on the geology of the South Staffordshire coalfield was one of the great classics of British science. All Midland men remembered Mr. Henry Johnson, a man eminent both as a geologist and as a mining engineer, and whose son he (Dr. Lapworth) was proud to number among his friends. Then there was Mr. Madeley, who had done so much good work among the Dudley fossils; and Mr. E. B. Marten, whose models of the district were perfect marvels of art and accuracy, while there were many others whose names it was impossible to mention. One thing was clear, namely, that the men of Dudley stood second to none in their knowledge of the local geology, and in the keenness and assiduity with which they had worked at the subject. Dudley might be said to be the very centre of Midland geology, the axis, in fact, round which the whole of that geology centred. If they were to climb to the top of the old keep of the Castle they would have before them a complete epitome of that geology. Underneath the ruins rose that old mysterious Silurian formation filled with its exquisite fossils. Surrounding the little disc of Silurian was the broad circle of the Black Country. Beyond that ring, which was from three to six miles in breadth, there was another concentric ring composed of Red Rocks, rising up in such heights as Clent and Barr Beacon, whilst beyond, looking in the direction of Oxford, they saw remnants of another and larger ring,

the great ring of the Oolite and Lias, rising up into the heights of Edgehill, the Cotswolds, &c. Away to the north-west of the town there were the Longmynd and the Wrekin, and to the southward the jagged peaks of the Malverns, which were among the most interesting hills in Britain, for they were formed of those Archæan rocks of which we, as yet, know almost nothing. When they looked at any geological map of England they would see stretching from Hartlepool on the north-east and Blackpool on the north-west, far away to the south, a great band of Red rocks. These rocks attained a breadth in the Midlands of forty or fifty miles from Leicester to Shrewsbury. Rising out in patches through this band of rocks they found the carboniferous or coal measures; and these two measures—the red rocks and the coal rocks—made up the main features of the Midland area. He might compare them to two blankets—a red blanket above and a black blanket below; but the black blanket only showed through where time and weather had worn holes in the red blanket above. Now these two sheets of rock were once covered up by others, the Oolite and the Lias, but both these had long been swept away in that district. Above these lay, in former times, the great sheet of the Chalk, which once spread from this country as far as Ireland on the west; and over the Chalk again came the blanket of the Tertiaries. The red rocks already spoken of, which followed the coal measures were divided into two, the Permian below and the Trias above. This last was of different thicknesses, varying from about 4,000 feet in Cheshire to less than 750 feet at Leicester and Nuneaton; and consequently in this easterly direction only 700 feet or so had to be passed before the underlying coal measures were reached. Geologists believed that the Trias was laid down in a desert like the Sahara, or in a saline plain like that around the Caspian Sea; and they would observe that there were salt basins which were naturally accounted for on this theory in our Red Rock formation, as at Droitwich in Worcestershire, and Nantwich and other places in Cheshire. The Permians, which came underneath the Trias, were at once of great interest and of great difficulty to Midland geologists. They were known to be older than the Triassic formations, because they were below them; but geologists had been very uncertain how they were related to the Coal measures on which they in turn reposed, for if they followed the coal in regular successive order, then wherever the Permians existed in force there were 2,000ft. or 3,000ft. to be pierced before the carboniferous measures were reached. On the other hand, if they rested on the edges of the coal measures unconformably, the ease

with which the coal could be reached would be very greatly enhanced. Years ago it was thought that here with us they usually followed the coal in regular order; but evidence had been got in the north of the coalfield and elsewhere that the Permians often rested only on the edges of the coal measures. This discovery had opened up quite a new era in the economical geology of the Dudley district, because there was now shown a possibility of winning coal between the nearly worked out old Staffordshire district and Coalbrookdale; and of course precisely the same thing followed in regard to the Permian districts on the east of the South Staffordshire coalfield, so that now we might presume that from Walsall to Tamworth, and from Tamworth to Ashby, the chances were that there was a continuous sheet of coal at no great distance from the surface ready to be worked. Of perhaps less economic interest, but of greater scientific interest than anything he had yet referred to, were some points in the Clent and Stourbridge neighbourhood. There, geologists found curious chips of limestone, ashes, lava, &c., forming great sheets of strata. Professor Ramsay held the theory that these curious rocks were carried from Shropshire and Wales on the back of glaciers and dumped down where they now were, whereas Mr. Jukes, the Dudley geologist, was of opinion that the materials were brought down from rocks and hills then close by, and deposited by the ordinary denuding agencies. Within the last few years Jukes's theory had been all but proved to be correct; and, among the local geologists who were at work on this subject, Mr. Wickham King, the secretary of the Dudley Geological Society, had already distinguished himself by discoveries in that direction. Reverting again to the coalfield of Dudley, Dr. Lapworth said that the local coal measures were simply a portion of the enormous sheet of black rock which underlay the new red sandstone. In the Northern English coalfields, the measures were very much thicker, and they rested upon an enormous thickness of the limestone belonging to the carboniferous. In the Dudley district this limestone, &c., was altogether wanting, and while the lower coal measures were unknown, there were left only the higher measures, in the middle of which occurred our Thick Coal bed, which constituted the finest seam of coal on this side of the Atlantic. The section, prepared by Mr. H. Johnson, hanging on the wall, was that of the thick coal as it once existed at Parkhead, where it measured about 32ft. The Thick Coal was not found over the whole district, but existed as far northward as Walsall, as far southward as Oldbury, and westward nearly as far as Stourbridge; but there was very little doubt it once extended under the red sandstone as far eastward as the neighbourhood of

Coventry, and westward, but in split up seams, as far, perhaps, as Coalbrookdale. Its existence to the east of our coalfield had already been proved at Sandwell and at Hamstead, where the Thick Coal had been found under the red rocks at a depth of 1,800 feet, and it was not outside the limits of probability that a continuous coalfield would be found to exist below the red rocks from Flint on the one hand to Leicester on the other. Professor Lapworth went on next to describe the rocks on which the coal measures rested. It was only within the last few years that they had been able to map these rocks, and they were now divided into Silurian, Ordovician, Cambrian, and Archæan. About the last they knew very little, but he might note *Caer Caradoc* and the *Longmynd* as peaks of Archæan rock; and they rose up again at *Malvern* and *Charnwood*, which gave the direction in which the mountains of the pre-carboniferous continent lay. Cambrian rocks were found at the *Lickey*, while the Silurian Limestones were prominent at *Dudley*. These *Dudley* Silurian limestone rocks stretched westward, and appeared again at *Wenlock*, while to the eastward they had been traced into France, Germany, and Russia. These limy rocks had doubtless been laid down in very deep water, though not so deep as the present oceans; and he need not tell them that their presence in proximity to the coal and ironstone of South Staffordshire had doubled the value of these deposits by reason of the usefulness of the limestone as a flux. Hitherto he had been speaking of stratified rocks, but there were other rocks in the neighbourhood of which he might say a word or two. There were the basaltic hills of *Rowley*, about two miles in length and 200 feet in thickness, underneath which the coal measures lay but little altered. The lava which formed these hills apparently came up through cracks caused by earth movements, and the same material was found here and there injected through the coal. It was greatly to the credit of the *Dudley* mining engineers that they had had the enterprise to sink shafts through the *Rowley Hills* in the scientific faith that the coal would be found below. Another interesting class of rocks in the neighbourhood of *Dudley* was that class of glacial origin. In times not so long ago, reckoned geologically, our district was believed to be covered with glaciers and icesheets, from Scotland and North Wales, and on these were borne rocks which were exactly of the same kind as those in the South of Scotland, the Lake District, and in North Wales. After a few words on the great western and eastern faults, Dr. Lapworth said he hoped that a few thousands would be risked in the endeavour to find coal beyond them, and that he trusted, if found, it might be at such a depth that future engineering invention would allow of its

remunerative working. The Dudley district of Britain was, perhaps, more valuable for its size, from an economical point of view, than any other ; while from a geological point of view there was no district where the problems presented were more interesting or more fascinating to the geologist. Every new discovery made by the men of the Dudley district affected the geology of the whole of the Midlands, and he congratulated the members of that Union on their visit to a district and a town of such great and far-reaching interest. He would urge all present to push onward to the future, proud of the past and its results, helping on the continued progress of the science they loved, and encouraging and stimulating each other to renewed exertions and fresh discoveries.

On the motion of Mr. Amphlett, seconded by Mr. E. B. Marten, a hearty vote of thanks was passed to Professor Lapworth for his address.

BIRMINGHAM NATURAL HISTORY AND MICRO-SCOPICAL SOCIETY.

SOCIOLOGICAL SECTION.

During the last half-year seventeen meetings of this section have been held, six ordinary and eleven supplementary, under the presidency of Mr. W. R. Hughes, F.L.S., except on the first meeting, when the chair was taken by Mr. Alfred Browett. The ordinary meetings were held on the following Tuesdays :—

January 27th, when Professor Hillhouse read an address on the “Inductions of Sociology.” In the course of a masterly paper, the Professor made the original contention that the conception of a society was not complete if it took cognisance of the human units alone. He contended that the various means with which mankind supplements its efforts are integral parts of society : without them society could not have arisen and could not exist. He maintained that the adjuncts form a skeleton part, round which the units live and move, as leaves ; the active parts of plants come and go, leaving the framework of the tree much as they found it. Professor Hillhouse based his arguments upon the contention that a scratching stick in the hands of a savage became, as it were, a portion of him, but detachable—“a separable finger-nail ;” similarly a stone became a detachable missile fist.

February 24th.—This meeting was held in the Biological Lecture Theatre, about one hundred members and friends

being present. Mr. Charles Pumphrey, President of the Society, gave an interesting and instructive photographic display of English scenery, under the happy title of "Holiday Notes." The slides thrown on the screen, illustrative of inorganic, organic, and super-organic phenomena, were much appreciated by the audience.

March 24th.—Mr. W. Kineton Parkes read a paper on "Henrik Ibsen and his Studies in Sociology." In the discussion which followed, several members expressed unfavourable opinions of the Norwegian dramatist's views of life.

April 28th.—Miss Goyne, the hon. secretary, read a paper entitled "Thoughts from Robert Browning," in which attention was drawn to points of agreement between the teachings of the psychological poet and the philosophical conclusions of Mr. Herbert Spencer.

May 26th. — At this meeting sixty-one members and friends were present. Mr. J. Cuming Walters read a paper on "King Arthur's Land," in which ample evidence was afforded of that poetic power and vitality which have made the Arthurian Legends a fruitful source of inspiration to the English muse, affecting in a marked degree the poetry of this century. At the close of the meeting many present testified to the rich literary and poetic treat Mr. Cuming Walter's kind genius had given them.

June 23rd.—Mr. W. B. Grove, M.A., read a paper entitled "Thoughts on a Plea for Liberty." In an exhaustive paper, which was received with marked appreciation, Mr. Grove confined his attention to a consideration of the valuable "Introduction," written by Mr. Herbert Spencer.

At the supplementary meetings, which have been held on the second and fourth Thursdays in every month, the whole of the second, and most of the third part of Mr. Herbert Spencer's "Principles of Sociology" have been read and discussed by the members.

These meetings were held in the following order:—

January 8th.—Mr. W. R. Hughes, F.L.S., president of the section, introduced, by a few notes, Chapters I. and II. of Part II., "What is a Society?" and "Society as an Organism." In his concluding remarks Mr. Hughes suggested for consideration that, if in respect to the human species society may be regarded as an organism, we ought to find an analogy among the lower animals. Instances of the Beaver, Rooks, Ants, Bees, Wasps, &c., were adduced, which seemed to indicate a polity. Reference was made to Mr. Herbert Spencer's recent papers, in which he directed attention to the fact that the rudiments of justice appeared in these animals and others.

January 22nd.—Miss Byett read Chapters III. and IV., “Social Growth” and “Social Structures.”

February 12th.—Mr. P. H. Levi gave an exposition of Chapters V. and VI., “Social Functions” and “Systems of Organs.” In conclusion, Mr. Levi made the following deductions:—The present increasing tendency towards specialisation results in man becoming day by day more dependent upon his fellows. Under these conditions the absence of a due amount of the altruistic sentiments is manifested in socialistic and anarchical views. That a system of politics founded upon a knowledge of the principles of Sociology alone will lead to a more rapid evolution of that which is best for society. That a great bar to an intelligent appreciation of the lessons of Sociology is the belief in a special creation.

February 26th.—Mr. Alfred Browett read (with notes) Chapters VII. and VIII., “The Sustaining System” and “The Distributing System.” In conclusion, instances were cited of the recent growth and elaboration of the distributing system, resulting from the greater specialisation and co-operation of various and remote parts of the industrial system.

March 12th.—Mr. W. B. Grove, M.A., gave an exposition of Chapter IX., “The Regulating System,” which was followed by an interesting discussion.

April 9th.—Mr. J. A. Hill, F.R.M.S., gave an exposition of Chapter X., “Social Types and Constitutions.” In his summary, Mr. Hill drew attention to the present tendency of capital to consolidate into large companies with numerous shareholders, whereby the capital of the country becomes more and more spread over the community, while the control becomes more and more centralised, the tendency of this being, Mr. Hill considered, towards the socialistic ideal.

April 23rd.—Mr. Edwin Hill gave an exposition of the concluding chapters of Part II., “Social Metamorphoses” and “Qualifications and Summary.” Mr. Hill pointed out what he regarded as inconsistencies in individualistic teaching, especially in connection with the rearing and education of children, and to the growing difficulty as to the equitable adjustment of property held in land and capital. Mr. Hill saw little prospect of modern society progressing towards the Spencerian ideal, as he regarded the conditions which are modifying it unfavourable to such an evolution.

May 28th.—Mr. H. H. Spears opened the study of Part III. of Mr. Herbert Spencer’s “Principles of Sociology,” “Domestic Institutions,” with an exposition of the first and second chapters. It was pointed out that the controversy

provoked by a recent judicial decision tended to show that the laws relating to marriage were in an unsatisfactory condition, but that, before any decisive steps were taken, the subject required careful study from its scientific aspect. Mr. Spears expressed his belief that greater facilities for divorce were requisite, that the principle of monogamy was certain to be affirmed, as the one most adapted to higher civilisations, and that the moral value of any union was of more importance than the legal tie. Reference was made to the attitude of the Socialists towards the family.

May 28th.—Mrs. Browett read an exposition of Chapter III., “Primitive Relations of the Sexes,” which was followed by a discussion.

June 11th.—Mr. W. R. Hughes, F.L.S., President, read an exposition of Chapters IV. and V., “Exogamy and Endogamy” and “Promiscuity.”

June 26th.—Mr. P. H. Levi read a paper on Chapters VI., VII., and VIII.—“Polyandry,” “Polygamy,” and “Monogamy.” These chapters cover the whole evolution of the marriage contract up to its present condition. Mr. Levi concluded his interesting and important paper in the following manner:—“The ultimate object of marriage is to secure a family. This is proved by the frequently expressed desire of the childless to have children, and by the frequent adoption by the childless of the children of others.”

Having studied the evolutions of the past, we are better fitted to consider the tendencies of the present with respect to their natural sequence in the future.

Bearing in mind the many lives sacrificed yearly through the ignorance of parents, the thousands of children who grow up physically and mentally stunted through the same cause, we believe the sequence of our present rate of progress should be—women prepared for the rearing of a family by a thorough knowledge of physiology—men with a like knowledge. Both having studied the philosophy underlying the formation of a family, altruism should be their guide; mutual respect and confidence their motto. Both should so understand the rearing of offspring that, instead of expecting gratitude, in which expectation they would probably be disappointed, they should lay a foundation, resulting in love, respect, and admiration.

So long as the sequel to marriage is a mutual want of courtesy; so long as the family is reared to look upon small deceits as venial—so long will it be impossible to rear a race in which altruistic principles duly balance egoistic claims.

The chapters we have been studying give evidences of the great evolution of the marriage contract—an evolution which

connects the rude "Primitive Relations of the Sexes" with the fine ideal of married life not infrequently met with in modern times. Anyone who looks round and observes the higher types of men and women which even now exist must see that the evolution of their relationship with each other is making considerable progress, and will be led to believe that, given a favourable environment, this progress will continue until married life gains the height at which it completely fulfils all requirements. The path, however, is still difficult, but, as Emerson says, "He who aims high must dread an easy home and popular manners."

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—**MICROSCOPICAL SECTION**, November 3rd. A series of preparations showing the structure of the ovipositors and stings of insects was exhibited by Mr. A. Reading, and supplemented by Messrs. Carpenter and Iliff. The preparations, sixteen in number, related chiefly to the Hymenoptera and Diptera, but the Neuroptera, Orthoptera, and Arachnida were also represented. Mr. Reading gave some notes on the structure of the ovipositors and stings, and was followed by Mr. T. V. Hodgson, who briefly pointed out the probable line of their development, and who exhibited specimens of Orthoptera and Myriapoda in support of the theory. Mr. Suffield exhibited a specimen of *Sirex gigas*, captured near Broad Street, in the neighbourhood of a timber yard.—**BIOLOGICAL SECTION**, November 10th. Mr. R. W. Chase in the chair. Mr. W. B. Grove exhibited a fungus, *Clavaria stricta*, for Mr. Wright Wilson. Mr. W. R. Hughes, F.L.S., read a paper on his recent summer visits to the Marine Biological Laboratory at Plymouth. After giving a description of its external appearance, position, and internal arrangements for all branches of marine biological research, he exhibited and gave notes on a beautiful series of slides illustrating the migration of the eyes in the flat fishes (Pleuronectidæ) from a symmetrical to a lateral position; and also a slide of a species of Myzostoma, an external parasite of the Rosy Feather Star. These slides he had obtained, together with many others, through the courtesy and liberality of the authorities, amongst whose names those of Mr. Calderwood, M.A., the director, and Mr. J. W. Cunningham, M.A., the naturalist, were foremost. A short discussion, in which Messrs. R. W. Chase, J. F. Goode, C. Pumphrey, and J. Levick took part, and a vote of thanks to Mr. Hughes, terminated the meeting.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—October 19th.—Mr. J. Betteridge presented to the society's cabinet the following specimens:—Red-backed shrike, *Lanius collurio*; a pair of stonechats, *Saxicola rubicola*; green sandpiper, *Totanus ochropus*, and sparrow-hawk, *Accipiter nisus*. Mr. J. W. Neville proposed a vote of thanks to the donor, which was seconded by Mr. B. Cracroft, and suitably replied to. Mr. J. Collins then read a paper, "Remarks on Darwin's Voyage of the Beagle." After referring to

Dr. Darwin's fortunate and distinguished parentage, the writer gave an account of the origin of the cruise of the *Beagle*, an event that proved an epoch in this remarkable man's life. A number of extracts were read dealing with the zoology, botany, and geology of the countries visited, with remarks on the numerous observations with which this charming book abounds.—October 26th. Mr. J. Moore exhibited a small collection of local beetles; Mr. J. W. Neville, parasite of tortoise; Mr. J. Collins, living diatoms; Mr. Parker, a rotifer, *Monocerca rattus*.—November 2nd. ANNUAL MEETING AND PRESIDENT'S ADDRESS. The following reports were read:—General secretary's and secretary of committee's, announcing that the society had made satisfactory progress during the year; the treasurer's, that he had a balance of £3 4s. 10d. in hand; the curator's, that the properties of the society were in good order, and that several additions had been made to them during the year. The reports were approved and duly passed. Mr. W. Dunn then proposed Professor Hillhouse, M.A., F.L.S., as president for the ensuing year, and referred to the advantages the society had gained under his careful guidance during the last two years. Mr. S. Delicate seconded it, and it was unanimously passed. The President suitably replied. Mr. B. Cracroft proposed Messrs. Linton and Mulliss as vice-presidents. Mr. W. J. Parker seconded it, and it was passed. The other officers were re-elected. Mr. J. W. Neville proposed a vote of thanks to the president, and spoke of the kind interest he had always shown in the affairs of the society, of the stores of knowledge that had been placed at their service, and of the attention that had been given to their affairs. Mr. B. Cracroft seconded it, and it was duly passed, the President replying in a few words. After votes of thanks to the retiring officers and committee, the President delivered his address on "Some Thoughts on the Nature of Society," a subject that was suggested by Mr. Herbert Spencer's great work on Sociology. The writer said since man first began to think, few subjects have influenced him more than the problem of life. We know it is, we are conscious of its many powers, and are able to direct these powers to a common end. The nature and evolution that formed our relations with one another were spoken of, and though society consists of units, there is an immense amount of mutual dependence. The cohesion of society was compared with that of a lecture audience. Bees and ants were founders of societies of the simplest kind. The origin of society was traced from the earliest time. The simplest form of primitive man might use his finger-nails to dig roots for food, and his hands pulled fruits from the trees. Afterwards a stick and a stone might be used for the same purposes, when the stick became an improved nail and the stone an elongated arm, as when thrown it would knock down fruit that was out of reach, and it thus supplemented his natural gifts. When the fore limbs are used for grasping instead of walking, a functional change is commenced. A hunting spider chases its prey, a web-building spider catches it in a net, and one kind of functional capacity has been reduced and another has been enlarged. At a later time the plough became an improved stick, the bow and arrow an improved thrown knife or spear, and the cannon an improved thrown stone. All the implements of civilised society had their representatives in savage life. The human unit in no way differs from animals. He might generally make a better home, so does the tailor bird; he might lay up a store of food for winter's use, so does the squirrel. Man is a bi-lateral and bi-pedal animal; he has to look out for something to eat, and also to take care he is not eaten. His great care was his family; if danger came he

became the defender, and the woman a drudge. In what way does society differ from the life of a primitive pair? It is like a plant, and obeys the laws of nutrition, protection, and reproduction. These laws were described at considerable length. In the evolution of an organism, division of labour, though sometimes a necessity, is injurious to society, when the tool ceases to be an appendage of the man and the man becomes the appendage of the tool. The writer said he had not gone over the ground of the inductive philosophy of Mr. Herbert Spencer, but had introduced the subject to show society to be the grandest work the world has ever achieved.—November 9th. Mr. J. W. Neville read a paper on "The Life History of an Aphis." The writer said no insect, not even excepting the migratory locust, had inflicted such ravages on the earth as these insignificant flies. After reviewing aphides generally, and pointing out their places in the insect world, the writer took the rose aphis, *Siphonophora rosæ*, and traced its life from the egg to the imperfect or viviparous female, and the progeny that were produced at such an enormously rapid rate. The anatomy of the insect was described at considerable length, the pseudovarium and ovarium of the imperfect and perfect females being specially dealt with. The cycle of life was said to be first an egg; this produced a viviparous female that brought forth many young during the summer. In the autumn perfect males and females appeared. These paired, the result being eggs, that remained on the tree during winter to produce imperfect females in the spring. The paper was illustrated by a series of drawings and microscopic preparations.—November 16th. Mr. G. Corbett exhibited specimens of carboniferous and graptolitic shale with alum crystals, and described the chemistry of their formation; Mr. J. Collins a collection of some of our rarer plants, including specimens of *Cochlearia anglica*, *Gentiana Amarella*, *Lagurus ovatus*, and *Lysimachia ciliata*.

BIRMINGHAM ENTOMOLOGICAL SOCIETY.—October 19th. Mr. R. C. Bradley in the chair. Rev. C. F. Thornehill showed a number of insects taken on Cannock Chase this year, including a melanic variety of *Cymatophora duplaris*; also a collection made in Buckinghamshire this year, including *Cleora lichenaria*, *Boarmia roboraria*, *Aventia flexula*, *Phorodesma bajularia*, &c. Mr. G. W. Wynn showed a beautiful series of *Geometra papilionaria*, bred from Wyre Forest larvæ. Mr. P. W. Abbott showed *Setina irrorella*, *Agrotis lucerneæ*, and *A. lunigera*, long series, from the Isle of Wight. Mr. R. C. Bradley showed *Acidia cognata* from Sutton, and *Acidia heraclei* from Moseley. Rev. C. F. Thornehill read notes on the recent discovery of *Stilbia anomala*, on Cannock Chase, in abundance. Until last year it was not known to be a Midland insect, and then it was found by Messrs. Thornehill and Freer in such numbers that the latter took 150 specimens; and this year it was equally common.—November 2nd. Mr. R. C. Bradley in the chair. Mr. Bradley showed *Gonyglossum Wiedemanni*, from Sutton. Mr. H. J. Sands showed *Calligenia miniata*, from New Forest. Mr. W. Harrison showed a specimen of *Epione apiciaria*, taken at Harborne on October 3rd this year. Mr. G. W. Wynn showed *Nudaria mundana*, from Cleeve Prior. Mr. C. J. Wainwright showed insects bought at the Rev. G. H. Raynor's sale, including fine variable series of *Hypsipetes elutata*, *Cidaria russata*, &c.

OXFORD NATURAL HISTORY SOCIETY.—November 3rd. A lecture was given by Dr. Collier on “Stiffness, Fatigue, Breathlessness: What they are and what they mean.” The lecturer first described the mechanism and functions of the respiratory organs. As most people knew, the air when it entered the lungs gave up some of its oxygen and took out with it a larger proportion of carbonic acid gas than it had when it entered. The explanation of it was that the oxygen of the air absorbed in the blood united with the carbon of the tissues to form carbonic acid gas with the elimination of heat. Violent exercise increases the production of carbonic acid gas, and consequently also the number of the respirations to supply more oxygen and to throw off the carbonic acid gas. To many it was, no doubt, curious that a man was much more exhausted after ascending a steep hill of, say, 200ft. high than after lifting a very heavy weight, but the explanation was very simple. In the first case the man was demanding of his muscles, and a large number of them too, the work required to lift himself—probably from ten to twelve stone in weight—through a vertical height of 200ft., while in the second case he only demanded of a small number of muscles the work required to lift a hundred weight or two through a very few feet. When a muscle, or a set of muscles, were used these did not work alone, but another set immediately began to work in opposition, and it was this opposition which controlled and governed the action of the muscles used. This was one of the reasons why young animals, colts, lambs, &c., made such grotesque attempts to use their limbs at first—the muscles had not yet learnt to act together. Stiffness was the bruising and rupture of the muscle fibres by sudden and violent exercise. The best remedies for it were hot baths, friction, and moderate exercise. Gradually increasing exercise strengthened the heart greatly, but violent exercise in an untrained state did incalculable harm, producing dilatation of the heart and the thinning of its walls. At the close of the lecture, Mr. G. C. Druce exhibited specimens of the following plants:—*Illecebrum verticillatum*, L., from Berkshire (collected by Mr. A. Fisher); *Sagina maritima* (Don) var. *alpina* (Don), from Scotland (G. C. Druce); *Anchusa officinalis*, L., Berkshire (G. C. Druce). The *Sagina* has not been found since 1800, when it was first discovered by Geo. Don on Ben Nevis.—November 19th. Lecture by Professor L. H. Vines, on “The Disappearance of Starch from Leaves.” The lecturer explained the way starch is formed in leaves and plants, and remarked that it is very easy to convert starch into sugar, but that the conversion of sugar into starch can only be performed by the plants themselves. He illustrated the lecture by some experiments, showing how ferment found in the salivary glands of animals converts starch into sugar. In malting, a ferment similar to that found in the salivary gland is extracted from the barley, called diastase. This diastatic ferment is present whenever starch is converted into sugar. As sugar can be detected in leaves which have been kept in the dark, it is thought that the ferment is present in the leaves, as in the seed. The lecturer exhibited two leaves from a castor oil plant, one of which had been put into boiling water immediately to kill it, and then into spirits of wine to bleach it; and the other, after being kept for twenty-four hours, was treated in the same way. The first leaf turned blue black, after being treated with iodine, thus showing the presence of starch; the second leaf remained uncoloured. If leaves are placed in chloroform for several hours the conversion of starch into sugar still takes place. An interesting discussion followed, in which the President, Mr. G. C. Druce, and Mr. Peters took part.

